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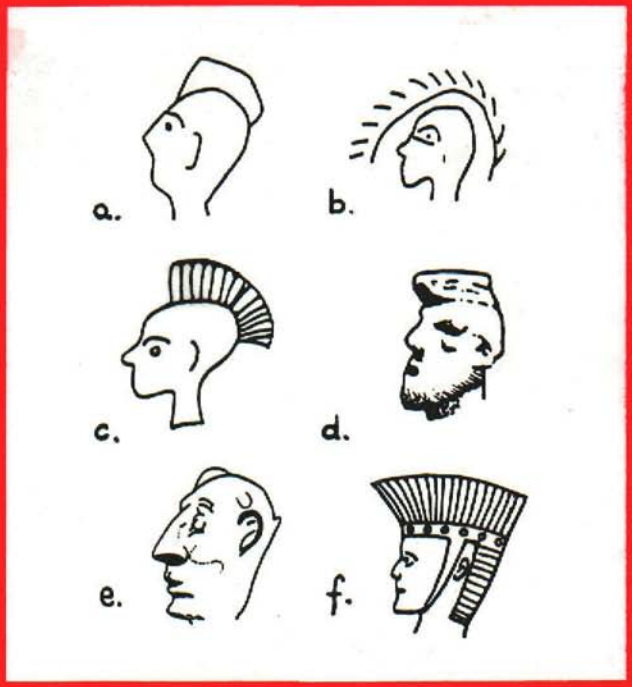

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Evolution, the Brain and the Arts

Valeri Dinev[1]
University of Sofia, Bulgaria

In the process of art creation, the different artists are guided by imagination, which to a great extent prevails over belief, intuition, reason, even feelings. It is imagination itself that gives people the possibility to view life not through the prism of religion, philosophy or science, but through art. That is why art becomes a material expression of their "inner reality" where imagination has unified the spiritual and the material, the divine and the human, the ideal and the natural, the classic and the romantic, the traditional and the progressive, etc.[2]

For many thinkers the social and cultural background influences greatly artists and to a great extent predetermines their idea of the relation man – nature. G.Rowley, for instance, holds the view, that in Chinese culture this relation is characterized by harmony and unity, while the western culture favours extremities – man is perceived either as lord of nature or as a nonentity. Man is either a "wreath of creation" or a victim of violent natural forces.[3] He believes that this could not but influence the total difference between eastern and western cultures, and hence art. Studying in detail eastern painting and other eastern arts G. Rowley arrives at the conclusion that cultural differences are due to fact that the Greeks keep to reason as a means to achieve perfection and beauty while the Chinese relied

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[1] Professor Dinev may be reached for comment at the Department of Philosophy, Sofia University, 15 Ryski Bd., 1000 Sofia, Bulgaria

[2] Роули, Дж. Принципы китайской живописи. М. 1989 г. с.10 (G. Rowley, Principles of Chinese painting. Princeton Univ. Press. 1947).

[3] Ibid. p. 32

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more on intuition and imagination, than on reason.[4] Hence the conclusion, which the author considers valid for the Chinese artist, who would not say "I think, therefore I am" but rather "I am, therefore I create". Because of this, the rationalization of the creative process is something contrary to the fundamentals of Chinese culture. That is why, according to G. Rowley, the Chinese do not attempt to rationalize the beautiful. In other words they do not treat the beautiful as something of high value connected with the good and the truth. Beauty is looked upon as an object of aesthetic pleasure.[5]

This difference between cultures and its influence on art undoubtedly raises the question: what is the role of cultural traditions and what determines their character? The answer to this question is most often found in the origin of culture. Depending on the point of view offered by different sciences, different interpretations of cultural traditions are arrived at.[6] Archeology, for instance, investigates culture as a complex of values, acquired as a result of excavations which are proof of extinct civilizations. Ethnography studies the existing societies, describing the contemporary state of their cultures. Evaluating the motivation of behaviour, laws and prohibitions, communication forms, psychology lists different types of personality. Sociology looks at culture as a phenomenon engendered by the necessities of the society and their satisfaction by means of special institutions, determining and distributing cultural values. Philosophy, linguistics and ethnic studies are not far behind, as well as cultural studies.[7] But all of them did not succeed in capturing all aspects of cultural traditions in different societies, exerting great influence on the arts. A number of thinkers have tried to overcome this shortcoming by referring to evolutionary science in their studies. This has supplied sufficient evidence to point to various evolutionary facts

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[4] Ibid. p. 50

[5] Ibid. p. 52

[6] Абрамян Э.Г. У истоков культурной традиции. Ташкент, 1988, с.9.

[7] Уайт Л. Науката за културата. С. 1988. Leslie A. White. The Science of Culture. 1949. N.Y.

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in cultural traditions which have an impact on the arts.[8]

For many scientists, an important evolutionary factor that has a bearing on the nature of the arts is the functional asymmetry of the brain.[9] Related studies have shown that the left hemisphere is connected not only with controlling the right side of the body, but also with analytical processes, related to speech and the consecutive processing of information, i.e. this is the rational hemisphere. The right hemisphere not only controls the left part of the body, but also spatial and visual perception, the total perception of images, i.e. this is the intuitive hemisphere.

The idea that the functions of the hemispheres reflect different types of thinking, corresponding to a certain culture has been associated with R. Ornstein, J. Bogen, Makoto Kikuchy, etc.[10] According to Ornstein "There exist two types of mind in man – analytic and holistic. The former is an expression of the "rational", the latter of the "intuitive" part of man." He holds the view that they complement each other, but this does not hinder the specialization and domination of one over the other. As a result, those who apply one way of thinking can rarely use the other. In Western culture he exemplifies this with the exchange of the religious ideal that had existed for centuries with the scientific, i.e., the transition from an irrational to a rational type of thinking. As a result of this change, in Western culture the rational type became predominant, which is related to the left hemisphere, as opposed to the dominating irrationality of the right hemisphere in the Eastern culture. For R.

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[8] R. Boyd and P.J. Richardson, Culture and the Evolutionary Process. Chicago University Press. 1985; L.L. Cavalli-Sforza and M.W. Feldman. Cultural Transmission and Evolution: A Quantitative Approach. Princeton. N.J. 1981; C.J. Lumsden and E.O. Wilson. Genes, Mind and Culture: The Coevolutionary Process. Cambridge 1981.

[9] Спрингер С.Г. Дейч. Левый мозг, правый моэг. М. 1983 (Sally P. Springer and Georg Deutsch. Left Brain, Right Brain, N.J. 1981) Валери Динев, Модели на човешкото поведение, С. 1993.

[10] R. Ornstein. The Psychology of Consciousness. San Francisco. 1972; J. Bogen. The Other Side of the Brain: Some Educational Aspects of Hemispheric Specialization. UCLA Educator 1975; M. Kikuchy. Creativity and Ways of Thinking: The Japanese Style. *Physics Today*. 1981, Vol. 34. 9.

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Ornstein the emphasis in education and culture in Western societies on rational thinking develops the capabilities of the left hemisphere while the East stresses the development of the right hemisphere.

The differences between eastern and western thought and hence the difference in expressing and understanding their cultures from the point of view of functional asymmetry of the brain is best exemplified by the article "Creativity and ways of thinking: the Japanese style" by Makoto Kikuchy. He draws attention to the principal difference in the type of thinking between the Americans and the Japanese as representatives of different cultures. According to M. Kikuchy it even finds expression in the way in which the American and the Japanese will explain how to get to a certain place. The Japanese will not say the names of streets and the number of houses you pass, as the American would do. On the contrary, he will provide a picturesque image with the colour of houses, their configuration and location with respect to one another. Giving numerous other examples, M. Kikuchy points out that in the process of communication, whether formal or informal, the Japanese are not inclined to use simple phrasing of the type "yes - no". The clear distinction between "black" and "white" is not typical for their culture. The Japanese themselves are much more sensitive, according to M. Kikuchy, than the Americans to colour nuances, to the whole spectrum, independent of the fact whether it concerns perception of nature or relations among people.

All these examples show, that apart from the presence of different social, psychological, economic, cultural, etc. factors, an important role in the formation of a culture have the evolutionary factors. With their help (in this case, the functional asymmetry of the brain) we could view man from a different angle – not only as a representative of a certain culture, but also as an artist.

For a number of authors, the functional asymmetry of the brain is one of the innate premises, developed in the course of evolution, which determine not only the belonging to a certain culture, but also many of our capabilities, which reflect on such a human activity as

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creativity.[11] During the last 25 years a lot of neuropsychological studies have come out that treat the left and right part of the image, the image and its reflection, and have tried to explain the connection between the aesthetic predominance and the lateral dominance.

There have been many references in art literature to the relation between lateral orientation in picture painting, tapestry making or engraving, and the aesthetic value of their performance from the artistic point of view.[12] According to Jerre Levy, H. Wolfflin [13] was the first to acknowledge in 1928 in Paul Wolters Festschrift, that there is a definite tendency towards developing the picture from left to right, and as a result, the most important element appears in the right part of the painting. As proof of his idea that this scanning tendency determines the way in which a painting is perceived, he compares Raphael's sketches and the tapestries with reverse mirror image, based on them and arrives at the conclusion that the full effect of Miraculous Draught, Charge to Peter, Holding of the Lame Man and Death of Ananias is achieved in the reversed image. Wolfflin, however, thinks that the place of the dying Ananias at the left of the tapestry, which according to him is not a usual position, represents a purposeful attempt by Raphael to shock the spectator.

Although A.P. Oppe shares his view that left to right scanning

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[11] Jerre Levy. Lateral Dominance and Aesthetic Preference. *Neuropsychologia*, 1976, Vol. 14, pp. 431-445; John P. McLaughlin, Pamela Dean and Philip Stanley. Aesthetic Preference in Dextrals and Sinestrals. *Neuropsychologia, 1983.* Vol. 21. No. 2, pp 147-153; John P. McLaughlin. Aesthetic Preference and Lateral Preferences. *Neuropsychologia*, 1986, Vol. 24. No. 4, pp. 587-590; Ian E. Gordon and Caroline Gardner. Responses to Altered Pictures. *Br. J. Psychol.* 1974, 65, 2. pp. 243-251; Dirk R. Spennemann. Handedness Data on the European Neolithic. *Neuropsychologia*, 1984, Vol. 22, No. 5 pp. 613-615.

[12] A. P. Oppe. Right and Left in Raphael's Cartoons. J. Warburg and Courtauld Inst. 7, 82-94, 1944; M. Gaffron. Left and Right in Pictures. *Art Quarterly*. 13, 312-331, 1950; P. Schwartz and D. Hewitt (1970) Lateral Organization in Pictures and Aesthetic Preference. *Percept. Mot. Skills* 30: 991-1007; B.T. Jensen (1952) Left-Right Orientation in Profile Drawing. *Am. J. Psychol.* 65: 80-83; Ch. G. Gross and M.H. Bornstein (1978) Left and Right in Science and Art. Leonardo. Vol. XI, Pergamon Press, Oxford, pp. 29-38.

[13] H. Wolfflin. "Uber das Rechts und links in Bilde", pp. 82-90, and "Das problem der Umkehrung in Raffaels Teppichkartons", 90-96. In Gedanken zur Kunstgeschichte, Schwabe, Basel, 1941.

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is an important determinant of aesthetic reaction, brought about by a picture or its mirror image, he also holds the view that the location of the spectator to the left or the right of the picture also holds important aesthetic implications.[14] More authors could be referred to, but they all stress the fact that the direction of unfolding of an image is dependent on the western custom to read from left to right or on the lateralization of the brain. Most of these authors, e.g. M. Gaffron,[15] hold the view that the direction is determined by the brain lateralization.

Going to depth into their studies, a number of authors arrive at very interesting conclusions. C. Gilbert and P. Bakan have discovered that the left half of a photograph of face has a greater similarity with the whole face than the right half with right-handed people. They demonstrated this by reversing the face and comparing the original with the mirror image of the same face, composed of two left and two right halves.[16] According to Jerre Levy[17] most authors do not assert that cerebral lateralization plays a role in our aesthetic choice and even enter into conflict with the conclusions of Wolfflin, Oppe, etc. that the most important content in works of art is located in the right side of the picture. This is, thinks Levy, completely understandable because there exists an asymmetric hereditary basis for our attention in the left part of space during visual perception and these pictures which tend to straighten this disbalance by moving the focus to the right will be considered as giving greater aesthetic pleasure.

J. Levy tries to prove if there is a dependency between the placement of the picture content and the hemispheric specialization in the aesthetic evaluation of pictures. Judging by the experiments

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[14] A.P. Oppe. Right and Left in Raphael's Cartoons. J. Warburg and Courtland Inst. 7, 82-94, 1944.

[15] M. Gaffron. Left and Right in Pictures. *Art Quarterly* 13, 312-331, 1950

[16] C. Gilbert and P. Bakan. Visual Asymmetry in Perception of Faces. *Neuropsychologia*, 11, 355-362, 1973

[17] Jerry Levy. Lateral Dominance and Aesthetic Preference. *Neuropsychologia*. Vol. 14, pp. 431-445, 1976

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carried out she arrives at the conclusion that right-handed people prefer those pictures on which the important content is located to the right of the spectator. Like a number of authors, as Wolfflin, Oppe, Gaffron, she thinks that right side location is not only due to our habit of writing from left to right. Because if this were the case, then people from Hebron or elsewhere in the Arab world would prefer the contrary possibility of locating picture content, since they do not comply to the European model of reading and writing. Such facts lead scientists to conclude that in interpreting art not only existing traditions should be borne in mind, but also the role of cerebral lateralization in their realization. As an end result of their studies we may arrive at the basic conclusion that the human aesthetic feeling is deeply affected by the fact that the human brain is laterally different.

Another scientist worth mentioning is Hans Joachim Hufschmidt[18] who has carried out important studies and made the conclusion that right-handed people paint 80% of the profiles facing left. In support of this assertion, he has investigated 50,000 profile images on paintings, vases, coins, mosaics, tapestries, jewels, etc. from ancient times to the present.

In all cultures along the Mediterranean before the Greek age, i.e. 600 BC, according to Hufschmidt, there is a predominant tendency of right orientation of the profiles by Assyrians, Egyptians and shumers. He traces this back to rock paintings from the Stone age, even though the ratio between right- and left-handedness has hardly changed since then. For Hufschmidt, the change in the direction of the profile starts in the early Greek period, then the lettering and profile turns from left to right. This change in profile is connected with the rapid intellectual development which hold true for culture up to the present.

Hypothetically the investigations, made on 50,000 objects are interpreted by Hufschmidt as a new conquest for higher intellectual achievement by means of domination of the right hemisphere, which led to preferences to the left part of the face.

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[18] H.J. Hufschmidt. Das Rechts -- links -- Profil im Kulturhistorischen Langsschnitt. Arch. Psychiat. Nervenkr. 229, 17-43 (1980); Zeichnungsrichtung, Schreibrichtung und Blickfelddominanz. *Eur. Arch. Psychiatr. Neurol. Sci.* (1985) 235: 76-81.

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Hufschmidt has carried out a number of studies in support of his conclusions. 138 right-handed people from both sexes between the ages of 16 and 46 had the task of painting a human profile. 32 of them remembered that they had painted a human profile before, but only 5 people said that they had painted one more often. Besides, he made them paint one profile with their nondominating hand. 100 left-handed people from both sexes aged between 16 and 46 had the same task. Here the percentage of people that had painted such a portrait was smaller. They were also made to paint with both left and right hand. This group of left-handed people usually used their left hand, 60% of them wrote with their right hand as well, but all could write with their left hand.

The results Hufschmidt obtained are quite interesting. As the table below shows, the 138 right-handed and 100 left-handed people, 8 combinations were arrived at. About 80% of the right-handed people paint with the right hand towards the left (combinations 3 & 4), but only 58% of the left-handed paint with the left hand towards the right (combinations 6 & 8).

	COMBINATIONS	138 Right Handed		100 Left Handed	
1/5	right hand left left hand right	2	1.4%	4	4%
2/6	right hand right left hand right	27	18.6%	11	11%
3/7	right hand left left hand left	55	40%	38	38%
4/8	right hand left left hand right	54	40%	47	47%

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Combination 1-4 with right-handed people
Combination 5-8 with left-handed people
Combination 3+4 = 80% with right hand towards the left with right-handed people
Combination 2+4 = 58.6% with left hand towards the right with right-handed people
Combination 7+8 = 85% with right hand towards the left with left-handed people
Combination 6+8 = 58% with left hand towards the right with left-handed people.

The different combinations show that there is no symmetrical relation between left and right hand in an individual. With right-handed people we find 40% mirror image (combination 4) and with left-handed people 47% (combination 8), i.e. with right hand to the left and left hand to the right. According to Hufschmidt, mirror image could be expected if the direction of the painting depends on preferences of the contracting muscles.

He asserts, that when profile paintings by both hands face the same direction, those oriented to the right are considerably fewer: with right-handed people half of the left-oriented (cf. combination 2 to 3) and with left-handed people only one third of the left-oriented (compare combination 6 with 7). Independent of the separate striving for symmetry, the left preference with right- and left-handed people dominates even though it is more emphasized with right hands. For Hufschmidt, the most impressive are the results of the 4 combinations at the bottom of the table. Left- and right-handed people have in the respective combinations almost the same percentage, independent of the opposite motor domination. The direction of the painted profile does not depend so much on the dominant side, but on the generally preferred optical projection.

The conclusions, according to Hufschmidt, are that studies on right- and left-handed people show considerable predominance of left-oriented profiles. Right-left orientation of the picture is not simply associated with the activization of the contraction muscles of the hand. In painting with the right or left hand the individual does not achieve an exact mirror image of the profile direction, nor

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between the right and left image of the profile.

For some authors, the left or right picture orientation is genetically innate and not functionally determined. This is exemplified by early childhood paintings, where 70% are oriented spontaneously to the right. In connection with this, Hufschmidt points out that children paint mostly by memory not looking at the object. This shows that we cannot speak about something innate in the sense of K. Lorenz. In support of his idea of the left orientation of the profile in right-handed, people Hufschmidt shares the view of many researchers that this is probably connected with the fact that perception with right-handed people is more differentiated in the left side of the face.

In his studies, Hufschmidt comes across some interesting facts. Leonardo da Vinci, for example, who wrote and painted exclusively with his left hand, has 53% tendency of right-oriented profiles, which approximately corresponds to Hufschmidt's experiments with non-painters - 58%. Another fact worth mentioning is that the percentage of left-oriented profiles in women is much greater than in men and this shows that convention is important not the biological factor. According to Hufschmidt this peculiarity has its roots in paintings with married pairs. In the beginning, the Christian pair was so located in relation to the altar, the priest and liturgy, that the man, heraldically speaking, is to the right of the priest of the epistolary side, that is why the male profile is turned right from the point of view of the spectator, and the female to the left. From this religious convention we arrive at the stylistic element of the married pair. This element, however, is not encountered in Italy, but mainly in Germany, Holland and England between 1500 and 1700. Hufschmidt thinks that if we study this group as something specific and separate from statistics, we will get a clear picture of the biological participation in left orientation.

Having in mind everything for and against left and right orientation, Hufschmidt makes his basic conclusion that all is in support of the biological development of preferences in painting and writing and less so favours conventional or just traditional reason for left preference.

The principle of the dualism left-right, coming from ancient times makes a number of authors to assume not only its "input" in the

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organization itself of the brain (functional asymmetry of the brain supports this) but also to look for its new manifestations and dimensions. Such they see in the fact that the differences between sexes - male and female - are associated with the asymmetry of the left and right hand. And these sex differences are manifested in different colours.

In many examples of primitive art from the late paleolithic, for instance, is shown that a certain sign is depicted more often with the left hand than with the right. For the French anthropologist Andre Leroi-Gourhan[19], the sign with the left hand in many primitive societies symbolically depicts the female, and the right – the male. Discoveries made by anthropologists in different parts of the world (in this case in Kenya) showed that male skeletons lay on their right side when buried, while female – on their left.

The opposition left-right in paleolithic art was connected with differences in their colour expression. This could best be seen in the Lyasco caves. The animal heads on the left of the caves were painted red, while those on the right – black. Elsewhere, in Castillo, female signs were painted red and male signs – black. This can also be seen later in different stages of the biological and cultural revolution, according to Andre Gourhan.

The role of the dualistic opposition "left-right" (left hand - right hand) in ancient hieroglyphic symbols of the late paleolithic and the traditions later on of the binary code in culture makes V. Ivanov state that we should carefully study the ideas of A. Leroi-Gourhan, namely, that the change in the functions of hands in contemporary society could lead to serious consequences in art.[20] Such, at first sight, different phenomena, as automatization of production and nonfigurative (abstract) art (in its nature also hieroglyphic and not verbal) could turn out to be connected.

It is not out of the question, says V. Ivanov, for some truth to exist in the numerous appeals to pay attention to the increasing role

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[19] A. Leroi Gourhan. Le Geste et la Parole: La Memoire et les Rythmes. Paris, 1965

[20] Иванов В. Чет и нечет. Асимметрия моэга и знаковых систем. М. 1978, с. 84-87. (V. Ivanov. 1983. Gerade und Ungerade. Stuttgart, Hirzel.)

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of visual deans in the contemporary world. Besides, we have to stress that we talk about such means of conveying optical information (television, cinema, bordering on the documentary) that are oriented towards concrete perception of reality now. These are means, points out V. Ivanov, which are directly oriented towards the right half of the brain.

According to V. Ivanov here arises the question: won't the small child who watches the TV set be forced to exchange sound language with visual language, just as ten thousand years ago visual language was changed by sound language? Just as man can not stop the development of visual means for conveying information, it is also impossible to hinder the way of scientific knowledge. But in both cases, says V. Ivanov, it is useful to plan beforehand the consequences of development. And this to a great extent is determined by the nature of information and the channels of its entering our brain. This means that the information should be well studied because it is differently perceived by the two hemispheres. An important contribution in understanding the nature of the information has the French scientist Abraham Moles, who defends the idea that information perceived by man is of two types – semantic and aesthetic.[21] He asserts that man perceives semantic information when listening to the radio, reading a newspaper, a book, when he is at the theater, when he follows the actions, words of the actors, etc.; while its variety, the director's ideas, the perception of music (without text) is aesthetic information. In painting, the semantic information is the subject matter, the relation of balance and perspective, the anatomy and the symbols, while the aesthetic information (it prevails and plays a decisive part in the perception of the observer) is achieved by colours and the manner of depicting.

According to A. Moles, in contemporary painting the degree of originality is decisive, and the volume of information has considerably increased compared to the beginning of the XX century. Surrealism, for instance, increased the semantic information, severing the natural association which arise in the observer under the influence of his

[21] Моль, А. Теория информации и эстетического воспитания, М. 1966, с.195-209. (A. Moles. Theorie de l'information et perception esthetique, Paris, 1958).

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personal experience. It also broke away with perspective, functional connections between objects, people and the separate elements. Abstract art on its part increased the aesthetic information by destroying style and the traditional relation between colours. Each new artistic school sets out to seek disturbance in the distribution of its aesthetic components and other rules for their convergence.[22]

Analyzing in detail the nature of the two types of information, A. Moles arrives at the conclusion that there exists a clear differentiation between them which is the object of perception in the different arts. Semantic information, as contemporary studies show, is expressed by symbols, it is logically determined and transferrable and its perception is carried out by the left – rational hemisphere. Aesthetic information, on the other hand, is determined by the inner state of the participants in the creative (perceptive) process and this state is not transferrable. Its perception is carried out by the right – intuitive hemisphere.

Interpreting the relation left-right through the prism of semantic and aesthetic information, we think that the issue of prediction of the balance (between the two hemispheres) is easier to be carried out if we consider the degree of increase or decrease in the volume of the respective information. And this on its part will show the active participation or non-participation of the left and right hemisphere in perceiving or creating different arts and not only in that field.

In support of the evolutionary interpretation of the arts, we would like to give as evidence another type of studies that try to demonstrate that we inherit certain aesthetic abilities from our animal predecessors.[23] In a series of original experiments Desmond Morris (1968) made chimpanzees paint. Their works made an aesthetic impression on the human observer and in a very interesting way, besides. They are characterized by the following features. The chimpanzees painted the pieces of paper in a very proportional way.

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[22] Райнов, В.Г. Символното поведение на човека. С., 1993, с.228-229.

[23] I. Eibl-Eibesfeldt. Die Biologie des Menschlichen Verhaltens. Munchen 1984, p. 824-826; D. Morris. The Biology of the Art. London, 1962; Charles J. Lumsden. Aesthetics. In: The Sociobiological Imagination. N.Y. 1991.

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They obeyed the afore-given frame and filled it in a balanced manner. When Morris gave them a piece of paper on one side of which was drawn a square or a circle, the chimpanzees drew on the other side. Afterwards they connected the two structures with a few lines. Then the monkeys developed individual styles. One of them drew a picture in the shape of a fan with several variants. When they were given different colours, they did not use them haphazardly. If the animal had drawn a fan with one colour, for instance, it put the rest of the colours between those of the first structure. The activity they showed was like a game. The remarkable thing was that the animals knew when they were ready and hesitated to destroy their "picture" when they continued painting.

When he heard of Desmond Morris's experiment, I. Eibl-Eibesfeldt took brushes, paints and paper and went straight to the Hellabrunn Zoo in Munich in order to make two female chimpanzees draw. According to him, they started immediately with visible pleasure. The higher in the hierarchy chimpanzee filled the whole sheet of paper proportionally, while the other drew a blot in the bottom corner of the picture. When given another colour, it spread it on the other sheet of paper by pressing it so hard that in the end the paper was torn. The chimpanzee, according to Eibesfeldt, behaved as if it was afraid to spread the colour over the whole space. This strongly reminded him of the projection tests by psychologists, where the manner in which a man paints leads to conclusions about his personality. In balanced, healthy people, the tree with its branches is placed freely in the space.

We should like to say that Morris has exhibited his chimpanzee drawings in an exhibition hall of modern artists, without naming the "creators". Nobody managed to detect their animal origin and many people praised the paintings for their vitality and attractiveness as abstract art.

Analyzing the works of art of our predecessors, E. Eibesfeldt draws the conclusion that from all principles in the pictures, seven are typical for the chimpanzees:

1. Their activity is determined by their own will.
2. The composition is controlled and the space is filled with a feeling of rhythm and proportion.

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3. By practicing results became more differentiated.
4. Different individual styles developed which varied.
5. The picture was considered ready when an optimum state of order was achieved.
6. For the paintings by the monkeys a typical ordering was characteristic, i.e. general patterns, which they followed.
7. The pictures showed definite personal characteristics.

The chimpanzee does not create a picture in order to look at it afterwards, neither to use it for communicative purposes by means of its aesthetic perception by others, as is the case with humans; but it does show many methods common to painters. It is these things which together with the abilities acquired in the course of instruction that create the aesthetic taste in man.

Long ago, the founder of psychophysics, Gustav Fechner, stated that "man's taste is determined by an innate predisposition and instruction. The manner of its development is due to the innate predisposition but not only to it. Generally speaking, taste is a result of innate predisposition and the impact of education. And depending on the difference of the two, the taste varies."[24]

In our general analysis, we demonstrated our support of one side of taste – the evolutionary – but this does not mean that we discard or undermine the other. We tried to examine the one that is less known and that has up to now been in the shadow of the other in studying the nature of the arts.

[24] G. Fechner. Vorschule der Aesthetik. Leipzig. 1876, s.249.

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Human Breasts: Evolutionary Origins as a Deceptive Signal of Need for Provisioning and Temporary Infertility

Edward M. Miller[1]
University of New Orleans[2]

Female breasts enlarge during pregnancy and lactation. Since it is during these periods that provisioning the mother most benefits the child, males evolved to be more generous providers for women with enlarged breasts. Also, dominant males evolved to regard enlarged breasts as sexually unattractive. While this promoted their own reproductive success, it left such women free to be courted by the non-dominant males. Their courting involved provisioning the women, an act which also promoted their children's well being. Thus, women with enlarged breasts were better provisioned. Since, for the two reasons given above, women with enlarged breasts were better provisioned, women with the genes for preferentially depositing fat in their breasts left more descendants, causing such genes to be selected. In non-human primates where male provisioning was unimportant, preferential fat deposits in the breasts did not emerge because such deposits could not lead to better provisioning.

A casual answer to the question, "Why do women have breasts?" is to nurse babies. However, most breast tissue is merely fat, not milk-producing tissue. At puberty the human breasts enlarge through the development of both glandular tissue and fat. The human is the only primate whose mammary glands (breasts) are visibly enlarged in the absence of pregnancy or lactation (Neville, 1983, 105). This paper

[1] Professor Miller can be reached for correspondence at the Dept. of Economics, University of New Orleans, New Orleans, LA 70148

[2] New Orleans, LA 70148, 504-286-6913 (work), 504-286-6397 (fax), 504-943-3395 (home)

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is directed to why non-lactating women have conspicuous breasts. While the fat in their breasts supports nursing, so does fat elsewhere.

There has been earlier discussion of why women's fat is concentrated in their breasts (see Barash, 1982; Fisher, 1982; Harris, 1990; R. Smith, 1984; Montagna, 1985, for instance). Cant (1981) has proposed that large breasts provide evidence of abundant fat reserves. Gallup (1982) argues that breasts provide evidence of ovulatory potential. N. Smith (1986) suggests it is to provide softness for babies to hang on to. Low, Alexander and Noonan (1987) have proposed that fat deposits in the breasts make them appear able to produce more milk. Initially, males who chose to devote mating effort to women with prominent breasts got mates who were better able to nurse their children, causing the males to leave more surviving offspring. This led to a male preference for women with breasts. However, males could not distinguish large breasts due to fat from large breasts that really indicated much glandular tissue. Thus, women with breast fat deposits were more successful at attracting males. This selected for breast fat.

This argument was disputed by Anderson (1988) and by Caro and Sellen (1990) and defended by Low (1990). The author is inclined to doubt the Low, Alexander, and Noonan argument because women probably evolved to have the optimal amount of glandular tissue, with any additional such tissue reducing their fitness in some way. Males would have relatively little to gain from preferring women that had more than the optimal glandular tissue. In theory, males might gain by selecting women with more than optimal glandular tissue if the cost to the female of the extra tissue was increased mortality (perhaps reduced running ability, greater exposure to disease, depletion of her food reserves, etc) while the benefit of the extra milk went to the child. The male's genes, benefitting more from the child's health than the mother's health, might benefit if the mother could produce more milk. However, there are several reasons for doubting that male and female interests conflict much.

The survival of a man's children normally required the mother's survival. Any adverse effect of excess glandular tissue on the mother's health would probably appear within the first few years of a child's life, adversely affecting the child.

Theoretically, the genes for excessive glandular tissue could

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reduce her probability of reaching child bearing age, thus creating a conflict between male and female interests. However, breasts develop just before they are needed, i.e. at puberty, rather than in childhood. The genes affecting lactation are unlikely to have a significant effect on survival before they are turned on at puberty. Thus a serious conflict between male and female interests is unlikely. In the absence of a large scale conflict of interests, it is unlikely that the female fat distribution would have been selected to deceive males. However, this paper's purpose is not to add to the discussion of the Low et al. hypothesis, but to propose a couple of new hypotheses.

The Role of Sexual Selection

A slightly more sophisticated answer for why large breasts than "to produce milk" is to attract men and to induce them to invest in her offspring. The argument starts with the hypothesis that men like breasts, an observation that has been reported not only in western cultures but in ones as different as Indonesia (Marlinata, 1984). Flat chested women were unable to attract as much male investment, and thus their genes died out. Such sexual selection is capable of explaining how a male preference for females with breasts was maintained once men came to respond to them. Men who selected flat chested women as mates would leave flat chested daughters. These would be less attractive to men, and would be less well provisioned, leaving fewer descendants. Thus, once a male taste for female breasts emerged, sexual selection could maintain this taste, and maintain breasts. However, the question remains why such a male taste emerged.

This is a common problem for a sexual selection theory. It is easy to explain how a trait found attractive by one sex is maintained once it emerges. The problem is to explain how a trait, and a preference for it, first emerges.

Since most mammals lack large breasts except when suckling (Ford and Beach, 1951, 48), we cannot merely say that a male preference for them had been inherited from the human ancestors. It is necessary to explain positively why males developed this preference.

The key argument to be made here is that large breasts originally indicated a pregnant or lactating female. This in turn

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implies two facts: (1) She is in a stage of her life cycle when additional nutrition is most valuable. (2) She is less likely to be fertile. From each of these implications emerges a possible selective mechanism for large breasts.

The first part of the paper will discuss the implications of the lactating female's need for additional nutrition. The second part of the paper will deal with the implications of the non-lactating female's greater fertility.

Lactation as an Indicator of Nutritional Need

The Importance of Lactation

Lancaster and Lancaster (1987, 194-195) state that, "A strong argument can be made that, among the higher primates, access to energy to support a long lactation is the principal concern of the adult female." Lactation is more energy demanding even than gestation (Anderson 1983, 27). It is likely that a child's survival has frequently been determined by the mother's ability to supply adequate milk after gestation.

The problem of obtaining adequate nutrition during lactation is made more difficult because nursing itself consumes time that could be spent in food gathering, and because lactating women are accompanied by a vulnerable infant whose presence may interfere with food gathering. Indeed, among the Ache hunter-gatherers of Paraguay, lactating females gather fewer calories on foraging trips than non-lactating females (Hurtado et al., 1985). This is due to both lower efficiency and less effort. The lower efficiency is shown by their gathering only 2601 calories per hour of palm starch pursuit versus 3524 for non-nursing females (their Table VII).

Additional evidence that nutrition has frequently been difficult for lactating mothers is that women build up stores of body fat that are drawn on during lactation, and that ovulation is inhibited if the required fat deposits have not been built up (Frisch, 1989; Lancaster, 1986, 26-32). Fat reserves are built up during pregnancy even at the expense of the growing fetus. The accumulation of such fat reserves presumedly indicates that food intake during lactation was frequently inadequate. However, after a discussion of the literature in which some studies showed effects of nutrition on milk production and others did not, Casey and Hambidge (1983, 219) state "it is difficult

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to come to any definite conclusion as to whether 'feeding the nursing mother' does in fact 'feed the child'." However, common sense would suggest that at least severe maternal malnutrition would adversely affect the child.

Admittedly, even if malnourished, the mother may be able to maintain lactation by drawing on fat reserves. To the extent this happens, the time needed to rebuilt her fat reserves would delay the next pregnancy. Indeed, evidence exists that supplemental feeding shortens the period of postpartum infertility. In a Gambian study it was reported that, "Before supplementation, 19% of new conceptions occurred before 18 months after the birth of the previous child, whereas after supplementation, the proportion was 33%," (Casey and Hambidge, 1983, 219). A male who expected to father a lactating female's next child (presumably because he had or was creating a pair-bond with her) would promote his reproductive success by provisioning her.

Finally, there is anecdotal evidence from the siege of Leningrad and the hunger winter in Holland that the mother's capacity for breast feeding was maintained, but the duration of lactation was apparently considerably shortened (Casey and Hambidge, 1983, 226). Such a shortening would, of course, adversely affect a non-provisioner's child.

Given that males restricted their provisioning to likely mothers of their children, male provisioning during lactation was selected for. Males provided extra provisioning during lactation because they had evolved to view swollen breasts as attractive. In turn, females were selected for large breasts to attract such provisioning.

At the same time there was selection against any male tendency to find swollen breasts unattractive, since males with such feelings would have tended to stop provisioning their mates just when it was most needed. Prior to the emergence of male provisioning, it would have been in the male's reproductive interest not to court non-ovulating females whose swollen breasts evidenced their non-ovulating status. This male avoidance of females with swollen breasts would have been selected against for males who provisioned the females they were attracted to. Thus it should have gradually disappeared.

Of course, the exact genetic mechanism by which male standards

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of beauty are coded is unknown. One possibility is that the system is a polygenetic one, similar to that controlling other behavior. Some alleles contribute to an attraction, and other to a repulsion. The net effect is a summation of the effects of these different alleles. In this case, selection against repulsion by enlarged breasts would also promote male attraction to women with enlarged breasts. Thus, it is possible that a male preference for women with enlarged breasts could emerge as a result of the disappearance of a male repulsion to such women.

Female Rewarding of Male Provisioning During Lactation

Even in existing apes food provision can be rewarded with sexual access. Females appear to reward with copulations males who feed them, even having been seen to take meat from the mouth of the male copulating with her (Goodall, 1986, 483-484). Estrous females succeed more often at begging meat from males than non-estrous ones (Goodall, 1986, 483-484). Kano (1979) describes how bonobos (pygmy chimpanzees) presented and copulated with males offering desirable fruits. Once hominids had adopted hunting, males frequently found themselves with meat which could be distributed to females. Males naturally distributed this meat to females who gave them sexual access.

What type of provisioning should females reward most generously with sexual access? If the critical period for females is lactation, females paired with males who provisioned them during lactation would leave more descendants. Thus, females would prefer such individuals as mates, and would react negatively to any who "abandoned" them during this period. This would disadvantage any males who found enlarged breasts unattractive. Conversely, any who actually found enlarged breasts attractive would have a positive advantage. Such a male would endeavor to attach himself (by provisioning) to any female with enlarged breasts, including those who had been abandoned by partners who did not find enlarged breasts attractive. Since a male who provisioned a female during one lactation could be expected to provision her during subsequent lactations, women would benefit from forming permanent pair-bonds with such males. By attaching such males to them, they provide for their nutritional needs during future lactational periods.

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Thus, males who were attracted to females with enlarged breasts would be more successful in forming pair-bonds with such females. Even if the females were not fertile when the bond was formed, such males would have a long-run success in competing against males who abandoned their mates when lactation enlarged their breasts.

It is possible that women's intelligence and memory played a role. Women might very well observe which men abandoned their lactating and pregnant mates, and avoid forming pair-bonds with them even if courted. They would reason (correctly) that they would in turn be abandoned. Certainly, this would be a successful strategy for women, and the mental requirements would be within the probable abilities of early hominids. Even today, women seem to be close observers of the reliability of other women's mates, and denounce inadequate providers. Indeed, the ability of women to identify such unreliable providers, remember who they were, realize that they would probably do the same to a new mate, and resist courting by such males, may have led to the evolution of female intelligence, (and hence of human intelligence). Indeed, it has been argued one reason for racial differences in intelligence is that the selection for female ability to detect detection was stronger in the cold climates, where females, unable to hunt, were dependent on male provisioning to survive the winter (Miller, in press). This extends the paternal provisioning theory of racial differences (Miller, 1994) to explain differences in intelligence. Finally, the child of a man who was attracted by enlarged breasts would be better provisioned than children of one who was repealed by them, and hence abandoned his mate when lactation enlarged her breasts.

Evidence as to the plausibility of males competing by aiding females with child-care is provided by behavior in other primates. Smuts (1986, 393-394) observed that, "In a number of species living in multimale groups, males appear to contribute to offspring survival through baby-sitting, protection, occasional carrying, and other affiliating behaviors. Male parental investment does not fully explain these behaviors because the infants are often unlikely to be the male's own offspring." She then offers the hypothesis that male infant care sometimes represents mating effort rather than parental investment (see also Whitten, 1986, 357).

Once some males preferred lactating women with their swollen

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breasts, and women had evolved to form attachments to men who provisioned them during their greatest need (when lactating), the proportion of males and females with these genes gradually grew. In this account, disappearance of a dislike for enlarged breasts and attraction to enlarged breasts is partially a device for extending male provisioning beyond a short run purchase of sexual access. It may even have been a necessary step, since without it males would continually replace their pregnant or lactating mates with ones whose flat chests indicated they were capable of being impregnated. Long-term pair-bonding, or "marriage" required that a male's attraction to a female continue past her pregnancy and lactational period.

Emergence of Breasts

So far the argument has been devoted to showing that males should have evolved to preferentially provision females with enlarged breasts.

Such a male preference will lead to the emergence of large breasted females. The mechanism is simple. Extra provisioning is in the female's reproductive interests at all times, not merely when she is lactating.

A female with breast fat deposits appears attractive to men and receives extra provisioning. When she is not lactating, the extra food is still helpful and increases the number of her offspring (possibly by adding to body fat). When she is lactating, the extra fat will give her even larger breasts, and cause her to be preferentially provisioned over females whose breasts contain only tissues devoted to milk production.

Extra breast fat involves little costs. Females require large fat stores to carry themselves through the strains of pregnancy and lactation. If the fat is not in the breasts, it must be in other areas. Thus, a shift of fat to the breasts appears to impose no major costs. Because it motivates preferential male provisioning, it is selected for.

Lactation as a Fertility Indicator

Unattractiveness as a Female Strategy

This brings us to the second characteristic of lactating females (besides their need for nutrition). They are less likely to be ovulating.

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Smith (1984, 641) asks why human females have pendulous breasts, noting "Pendulous breasts should initially have been sexually repulsive, at least to high status males, because they would have signaled lactation, amenorrhea, anovulation, and therefore a female of little or no current reproductive value." He is correct, and why men came to prefer large breasts provides an interesting puzzle.

However, this unattractiveness to dominant males may not have been a disadvantage once male provisioning had appeared. Instead, not being attractive to dominant males can benefit females (Strassman, 1981). Let us explore this paradox since it could explain human breasts.

Prior to the evolution of hunting and male provisioning, hominids probably lived in multimale groups with social organizations similar to today's chimpanzees (see Goodall, 1986, for a description). With only limited scope for paternal investments, males maximize their reproductive success by devoting their efforts to maintaining dominance hierarchies and to preventing other males from mating with desirable females. While not completely successful at monopolizing desirable females, the dominant males generally are the most successful at reproduction.

What strategies are open to a non-dominant male? Prior to the emergence of provisioning, the best a non-dominant male could do would have been to steal an occasional copulation, or to wait until he himself became dominant (Goodall, 1986; van Waal, 1982, 1989). However, once hunting became common and males had food to distribute, non-dominant males could compete by offering more and better provisioning. The male may offer to invest in the offspring of a single female (or possibly a small number of females). His per capita investment is greater than the dominant male offers, and this can persuade females to cooperate in mating with him, possibly even going on consortships.

A low dominance male's optimal strategy is to concentrate his provisioning on a single female. Only by concentrating his provisioning can he make mating with him attractive enough to obtain female loyalty (see Miller, 1993 for a more detailed account).

Thus, with each non-dominant male concentrating his meat on a single female, females get more meat if paired with a non-dominant male than if in a dominant male's "harem."

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If female reproductive success requires male provisioning, females will be selected for those characteristics that lead to them being mated by the non-dominant males. These are the characteristics that make them relatively unattractive to dominant males.

One of the characteristics dominant males should be selected to find relatively unattractive is enlarged breasts, since these indicate a temporarily infertile female. Dominant males would spend very little time copulating with such females, or trying to prevent other males from copulating with them. Thus non-dominant males would enjoy relatively unhindered access to such females. Goodall (1986) has described how dominant male chimpanzees take the females closest to ovulation, leaving the other females for the remaining males. The same behavior probably occurred in early hominids. Since pregnancies occasionally occurred, non-dominant males were selected to find such females attractive, and to court them. Once males have provisioning available as a mating tactic, and females are exploiting it by forming long term attachments, the benefits of courting the females neglected by the dominant male extend beyond an occasional successful impregnation. Bonds formed then can carry over to a later time when the female is again ovulating.

Since large breasted females are better provisioned than other females, they leave more surviving offspring. Thus, the genes for fat deposits in the breasts are selected for. When lactating, these females will be among the largest breasted females, and will be better provisioned than other lactating females. When not lactating, they won't be as conspicuously "flat-chested" as other females, and may benefit from the preferential provisioning that results from being considered relatively unattractive by the dominant males. Thus, females came to be selected for large breasts, both when lactating and when not-lactating.

Smith (1984, 641) argues that "the evolution of perennial pendulous breasts could have initially evolved to provide females facultative polyandry." It is certainly possible that if a female's mate regarded her as less attractive because of enlarged breasts, she would find it easier to mate with others. Unfortunately, her mate would provision her less well, and in general this effect would outweigh the advantage of being able to more easily mate outside the pair-bond. However, if large breasts are viewed not as a device to cheat on a

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"husband" but as a device for avoiding unwelcome attention from a dominant male (such as rape), one has the theory of this paper.

After the first draft of this paper had been written, it was discovered that Knight (1991, 219) also argued that it was in early women's interest to avoid inclusion in a dominant male's harem, and that large breasts might help her do so.

The Malthusian Argument for Lactation Being Critical

It has been shown that circumstances exist in which males benefit by preferentially provisioning females with enlarged breasts. This raises the question of whether the circumstances in which humans evolved are such that males would have benefited by preferentially provisioning females with breasts. If they were, it can be argued that human males may have evolved to preferentially provision females with enlarged breasts. However, if circumstances were such that male provisioning was unessential, an argument that females were selected for success at inducing such provisioning is less convincing. For instance, evidence that currently most females receive enough food for adequate lactation (with the aid of stored fat) might be used to argue that prehistoric female reproductive success was not facilitated by attracting male provisioning.

There is a Malthusian argument that population density will be such that female reproduction is promoted by provisioning during lactation. Food will be abundant enough so that a female can provision herself when she is not lactating, but will have difficulty doing so when lactating. Consider the alternatives.

Suppose food was so abundant that lactating females were adequately fed without male provisioning. The population would grow in such a food abundant environment. As the population grew, they would compete with one another for food. Eventually food scarcity would stop population growth. The mechanism might be through unassisted females being unable to gather enough food to support lactation (remembering they would be carrying infants while foraging). Alternatively, a prolonged period between pregnancies to rebuild fat reserves might be required. We have now arrived at the circumstances in which male provisioning could make a difference.

Now consider circumstances where the population was so large that a non-lactating female could not quite support herself. She would

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lose weight and soon fall below the weight at which she could become pregnant. Any females who did become pregnant would have difficulty supporting lactation. The population would decline under these circumstances. Lower population pressure would gradually cause food to become more abundant. When population stopped declining, circumstances would again be such that male provisioning could make a difference.

Putting these two sets of circumstances together, the population is likely to be neither growing nor shrinking only when it has reached a level such that the food supply is adequate to support non-lactating females (and perhaps to permit them to slowly gain weight), but not to support lactating females without their having to draw on their fat reserves. In these circumstances, male provisioning is likely to make a real difference to a lactating female's milk production, or to the speed with which she regains weight and resumes ovulating after pregnancy, and hence to her fitness. This benefit to the genes of the male who provisions her (and whose child likely benefits), is likely to exceed the benefit from provisioning a non-lactating female. These are the circumstances in which males are likely to be selected for attraction to enlarged breasts, and in which females are likely to be selected for visible breasts.

Finally, once male provisioning is normal, population will increase to where non-provisioned females cannot reproduce themselves. Then, ability to induce male provisioning can determine reproductive success.

Miscellaneous Considerations

Notice this model can explain why humans are the only female primates with prominent breasts. Human males are the only male primates who regularly provision females with large quantities of food, and are hence the only species whose males are likely to have evolved to provide provisioning when it is most needed. They would thus be the only species whose females increase male provisioning by simulating lactation.

Supporting evidence that enlarged breasts serve to attract males rather than to serve some other purpose is that they appear as part of puberty rather than earlier. Attracting males prior to puberty would not contribute to reproductive success.

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Conclusions

Female breasts enlarge during pregnancy and lactation. Since it is during these periods that provisioning most benefits the child, males evolved to be more generous providers for females with breasts. Also, dominant males evolved to regard enlarged breasts as not sexually attractive. While this promoted their own reproductive success, it left such females free to be courted by non-dominant males. These males courted by provisioning, an act which also promoted their children's well being. Thus, females with enlarged breasts were better provisioned.

For the two reasons given above, females with breasts were better provisioned. Thus, females with genes for preferentially depositing fat in their breasts left more descendants, causing such genes to be selected for. Thus, breast fat, by mimicking pregnancy and lactation, deceived males, (or non-dominant males at least) into providing better provisioning.

Males were selected to find breasts attractive because this led to greater female provisioning when it was most needed, and greater male success in forming durable pair-bonds. These survived until the female was again ovulating. Of course, once the male preference for women with breasts emerged, the usual sexual selection feedback mechanism took hold. Having breasts showed possession of genes for breasts. Such female's daughters would inherit valuable male attracting genes. In non-human primates where male provisioning is unimportant, breast fat deposits did not emerge because they would not motivate better provisioning.

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Genetic Distance between non-Moslem Macedonians, Macedonian Moslems and Albanians

Jovan Damjanovski
Bitola, Macedonia

In the process of researching the similarities and differences between various populations including those of the Republic of Macedonia, the method J. Hiernauh for defining "Genetic Distance" has been used. There are a number of ways of calculating genetic distance. In the case of historical material, calculations have to depend largely on osteological material. However, for the comparison of living populations, J. Hiernauh (1965) has laid out a specific method by which it is possible to establish the similarities and differences between living populations. In spite of its advantages and contemporaneity, this method had its own weaknesses, but it is possible to augment it with whatever genetic data are available, thereby making very accurate indexes possible.

Hiernauh's formula for determining the genetic distance between two populations is as follows:

$$\Delta H \frac{10{,}000}{m} \sum^{m} (d^2)$$

In this case, *m* denotes the number of parameters which are mutually compared, *d* denotes the difference between the average for each parameter relating the greatest deviations for the parameters worldwide. The following types of characteristics have been used in this study: anthropometric and anthroposcopic characteristics, dermatoglyphics, blood groups and other data that can be expressed numerically. Hiernauh distance has the same deviations as any other distances, but it is well known for its huge biological advantage, which enables every available characteristic to be utilized when comparing any population with another.

To determine the Hiernauh distance, we took the average for

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TABLE 1. AVERAGES OF THE PARAMETERS AND INDEXES WITH THE MALE PUPILS ACCORDING TO THE RESEARCHED ETHNICAL GROUPS

PARAMETERS AND INDEXES	MACEDONIANS 13	MACEDONIANS 14	MACEDONIANS-MOSLEMS 13	MACEDONIANS-MOSLEMS 14	ALBANIANS 13	ALBANIANS 14
LENGTH OF THE HEAD	17,97	18,03	17,89	17,94	17,33	17,48
WIDTH OF THE HEAD	15,26	15,32	15,19	15,25	15,27	15,37
HEIGHT OF THE FACE	10,82	11,09	10,75	11,02	10,91	11,14
WIDTH OF THE FACE	13,00	13,25	12,85	13,14	12,75	12,98
HEIGHT OF THE NOSE	4,58	4,72	4,66	4,73	4,87	5,07
WIDTH OF THE NOSE	3,22	3,27	3,15	3,25	3,08	3,16
WDTH OF THE FOREHE.	11,50	11,69	11,51	11,48	11,16	11,32
WIDTH OF THE JAW	10,54	10,83	10,50	10,75	10,40	10,62
CEPHALIC INDEX	85,00	85,03	84,97	85,00	88,20	88,01
FACIAL INDEX	83,28	83,75	83,72	83,76	85,55	85,78
NASAL INDEX	69,00	69,41	67,72	68,67	63,57	62,66
HEIGHT OF THE BODY	152,34	159,03	150,11	154,00	150,69	156,62

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all parameters and indexes of the populations under study and then perform the mutual comparison. In addition, the procedure of G.Y. Henkey (1990), was also used for the same purpose of the comparing the populations: namely, the differences between the average for a certain parameter should be divided with the maximum deviation for that very parameter. G.Y. Henkey has performed this calculation for Central Europe. He squared the quotient which resulted from that calculation. This procedure should be done for all parameters. The results of the above-mentioned parameters should be totalled, the sum of which is to be multiplied by 833.33 since we have taken 12 characteristics for data processing in our research (1O,OOO/12 is exactly 833.33).

Finally the calculated values are compared, and it can be determined whether the distance pursuant to J. Hiernauh is bigger or smaller respectively. It is possible for the research to take in more features, but it is necessary that for each feature the maximum deviation between the populations can be calculated quantitatively.

In the Table 1, the average for anthropometric parameters has been presented as well as the indexes for the three different populations of students measured in Southwestern Macedonia.

In Table 2, the same averages have been illustrated, relating to the female students belonging to three populations in Southwest Macedonia.

Table 3 shows the maximum deviations for the anthropometric parameters as well as for the indexes which have been calculated and used by G.Y. Henkey (1990).

The data for "Genetic Distance" according to J. Hiernauh for the three researched populations in Macedonia is shown in Table 4.

In Table 4, the Macedonians are compared to Macedonian Moslems; Macedonians are compared with Albanians; and finally Macedonian Moslems are compared to Albanians.

The results obtained show that the genetic distance is the smallest between Macedonians and Macedonian Moslems, and the distance is the greatest between the Macedonians and Albanians, taking into consideration both male and female students aged 13 and 14 respectively.

The distance between Macedonian Moslems and Albanians is greater than that between Macedonians and Macedonian Moslems,

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TABLE 2. AVERAGES OF THE PARAMETERS AND INDEXES WITH THE FEMALE PUPILS ACCORDING TO THE RESEARCHED ETHNICAL GROUPS

PARAMETERS AND INDEXES	MACEDONIANS 13	MACEDONIANS 14	MACEDONIANS-MOSLEMS 13	MACEDONIANS-MOSLEMS 14	ALBANIANS 13	ALBANIANS 14
LENGTH OF THE HEAD	17,51	17,61	17,34	17,45	17,01	17,21
WIDTH OF THE HEAD	14,80	14,96	14,70	14,78	14,78	14,96
HEIGHT OF THE FACE	10,69	10,87	10,64	10,78	10,61	10,86
WIDTH OF THE FACE	12,77	12,91	12,72	12,83	12,65	12,75
HEIGHT OF THE NOSE	4,56	4,65	4,60	4,65	4,73	4,91
WIDTH OF THE NOSE	3,17	3,16	3,15	3,18	3,05	3,13
WDTH OF THE FOREHE.	11,44	11,63	11,33	11,48	11,14	11,24
WIDTH OF THE JAW	10,46	10,71	10,40	10,54	10,31	10,34
CEPHALIC INDEX	84,85	84,94	84,96	84,90	87,02	87,02
FACIAL INDEX	83,67	83,93	83,69	84,20	84,19	85,27
NASAL INDEX	69,92	68,49	68,49	68,24	65,04	64,38
HEIGHT OF THE BODY	153,04	157,03	151,59	153,72	150,91	154,30

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TABLE 3. THE BIGGEST DEVIATIONS FOR SOME PARAMETERS AND INDEXES

PARAMETERS AND INDEXES	MALE	FEMALE
LENGTH OF THE HEAD	8,60	7,19
WIDTH OF THE HEAD	5,61	4,96
HEIGHT OF THE FACE	5,96	7,14
WIDTH OF THE FACE	4,11	4,37
HEIGHT OF THE NOSE	4,75	5,19
WIDTH OF THE NOSE	3,38	2,23
WIDTH OF THE FOREHEAD	4,76	5,65
WIDTH OF THE LAWER JAW	4,84	5,51
CEPHALIC INDEX	3,93	3,99
FACIAL INDEX	5,31	5,56
NASAL INDEX	9,85	9,35
HEIGHT OF THE FOREHEAD	7,18	6,92

TABLE 4. HIERNAUH DISTANCE BETWEEN THE RESEARCHED POPULATIONS

AGE	MACEDONIANS MACEDONIANS-MOSLEMS		MACEDONIANS ALBANIANS		MACEDONIANS-MOSLEMS ALBANIANS	
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
13-	190,66	64,74	1171,91	635,49	826,58	355,66
14-	416,33	196,46	1104,82	578,66	1040,91	420,99

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although the difference is not as great as it is between Macedonians and Albanians. The same is the case with the females studied. The Hiernauh distance is the smallest between female Macedonians and female Macedonian Moslems, and the greatest between female Macedonians and female Albanians.

On the basis of these results, analyzed in accordance with the Hiernauh method for determining genetic distance, with all its advantages compared to those methods used until now - for establishment of the distinctions between two or more populations, it is clear that Macedonian Moslems are genetically much closer to Macedonian non-Moslems than to Albanians. This research indisputably shows that in all anthropometric parameters and indexes Macedonian Moslems are close to non-Moslem Macedonians than to Albanians. This fact is confirmed by the fact that the distance between Macedonian Moslems and Albanians is at a very high level, with regard to both young male/female students and older students.

This calculation of genetic distance would be even more persuasive in demonstrating the close relationship between non-Moslem Macedonians and Macedonian Moslems, the genetic difference between non-Moslem Macedonians and Albanians, and between Macedonian Moslems and Albanians if certain other anthropological characteristics had been included. Especially, confirmation for the obtained distance would have been strengthened if hematological and dermatoglyphic characteristics had been included in the procedure.

Conclusions

On the basis of the results presented above, the following results were obtained:

1. The genetic distance according to the Hiernauh method is the smallest between non-Macedonians and Moslem Macedonians of both sexes measured at the ages of 13 and 14.

2. Between the Macedonians and Albanians the distance according to the method of Hiernauh is the biggest regarding the

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same sex and age combinations as above mentioned.

3. The distance between Macedonian Moslems and Albanians is far greater than that between Macedonian Moslems and non-Moslem Macedonians, whether male or female (at the ages measured).

4. The Macedonian Moslems are much closer to Macedonians than to Albanians of the stated ages.

By this highly sophisticated procedure of researching genetic distances it is evident that the Macedonian Moslems are Macedonians and the achieved results show that they belong to the Macedonian nation.

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The Geography of American Achievement

Nathaniel Weyl

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The American Establishment
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Ethnic Background of American Lawyers and Doctors
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Author Nathaniel Weyl identifies a range of names which experts agree are broadly indicative of Japanese, Chinese, Hispanic, English, Jewish, Polish and other national origins. He then records the frequency with which these appear in social security records to assess their overall frequency in the American population as a whole, and compares the results with the frequency with which each name appears in biographical records associated with achievement in business, science, medicine and law, etc. Inter-breeding between diverse ethnic groups is taken into consideration.

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Non-Genetic Family Factors and Development of Schoolgirls from Progreso in Mexico

Napoleon Wolanski
Department of Human Ecology, Center for Research and Postgraduate Studies CINVESTAV, Merida, Yucatan, Mexico

Four factors: family education and income, family size, parental age and genetic-body-size, accounted for different percentage of the variance in adult stature in Poland (9-12%), Japan (13%), Korea (13%) and Mexico (27%). Overall, 0.2 to 5.3% of the variance in stature was explained by three non-genetic factors. It was postulated that variation in stature among four groups was probably related to other factors such as diet, sanitary conditions and lifestyle. Based on these results, variation in somatic traits and age at menarche of 1,010 females 9-28 years of age from Progreso, Mexico, was studied in the context of nine latent factors derived from a factor analysis of 25 variables dealing with aspects of the household and family conditions. Parental stature was not included. The nine non-genetic factors accounted for only a small percentage of the variance in the characteristics examined. Only 7.3% of the variance in stature was explained by parental education, hygiene, wealth, parental age and house humidity, while less than 2% of the variance of body weight was explained by wealth, hygiene and household equipment. Only 1% of the variance for triceps fatfold and age at menarche was explained by the factors under study. Clearly, most of the variation in somatic traits and age at menarche was not explained by factors related to household and family conditions. A more detailed analysis of diet and life style variables is probably necessary. Other potentially important factors are not immediately apparent.

In previous papers Wolanski (1990, 1994, 1995), Siniarska (1994), Wolanski et al. (1994), Wolanski and Siniarska (1995) and Wolanski & Zaremba (1995) postulated that in Japan, Korea, Mexico and Poland the main reasons of stature variance should not be accounted by education-income, genetic-body-size, famliy size and parental age alone. The observed variance of somatic traits had to be related to other factors.

Four family factors explained 27% of the variance in stature in

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the Mexican population, which was more than in Japan and Korea (13%) and in Poland (9-12%). Four of the family factors explained 4-10% of the variation in body weight, 0.3-2.5% in triceps fatfold and 0.2-2.9% in mid-arm circumference. The variance of stature was explained only in 0.2-5.3% by three non-genetic factors (Wolanski, 1995, Wolanski and Siniarska 1995, Wolanski and Zareba 1995).

The purpose of the present study was to find out the variance of several somatic traits and rate of maturation measured by age at menarche due to non-genetic family factors in Mexican girls. The hypothesis is that good physical development depends on good housing and living conditions. Responsible for the development of somatic traits are mainly such factors as diet, sanitary conditions and way of life.

Material and Methods

In the present study we analyzed 1010 girls aged 9-28 years (932 in age of 11-19 years) from the port of Progreso in Yucatan, Mexico. The studies were conducted during the summer of 1993.

The Mexican families are from a mixed Maya population of inhabitants of the sea port of Progreso to the north of Merida. Progreso is located 21 17' latitude of north and 89 40' length of west, 0 m on sea level. The Peninsula of Yucatan is a low limestone plain, characterized by tropical weather, with clearly different seasons: rainy season from June to September, "nortes" or winter northern winds from October to January, and a dry season from February to April/May. The mean annual temperture is 25.5/?**degrees symbol?**/C and annual precipitation is 444 mm (INEGI 1993). Solar radiation is highest in April-June (7.5 hours per day in May - in December 5.5 hours, Batllori 1994).

In the port of Progreso are concentrated fishery centers of the State of Yucatan which give 53.6% of whole fishing. In Progreso is also located 10 factories of fish flower, 3 of ice and 7 shipyards; it is also important tourist and recreation center (Pare and Fraga 1994).

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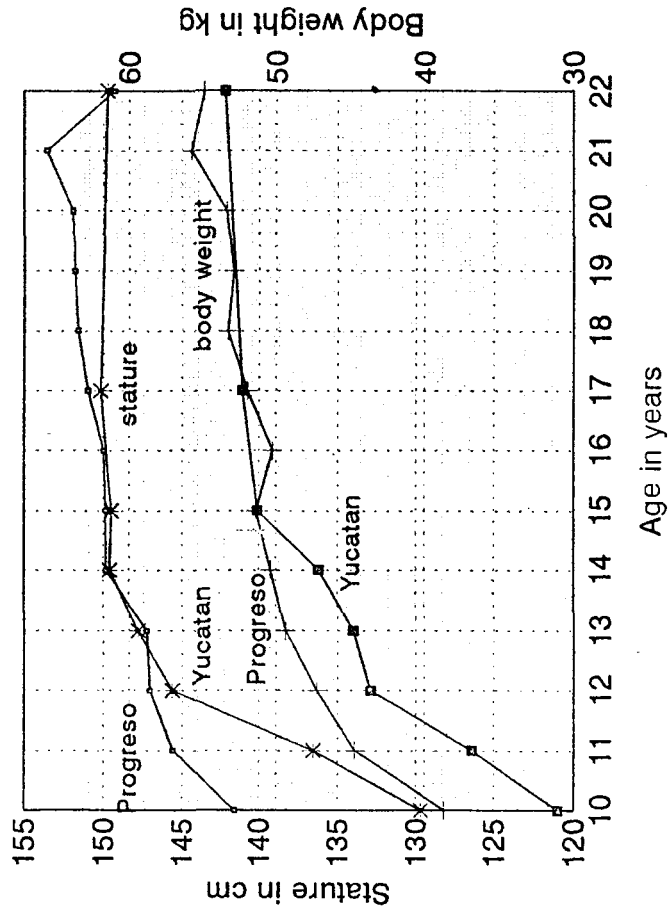

Figure 1. Body height and weight in Progreso menstruating girls in comparison with sample of Yucatan (Merida and Progreso)

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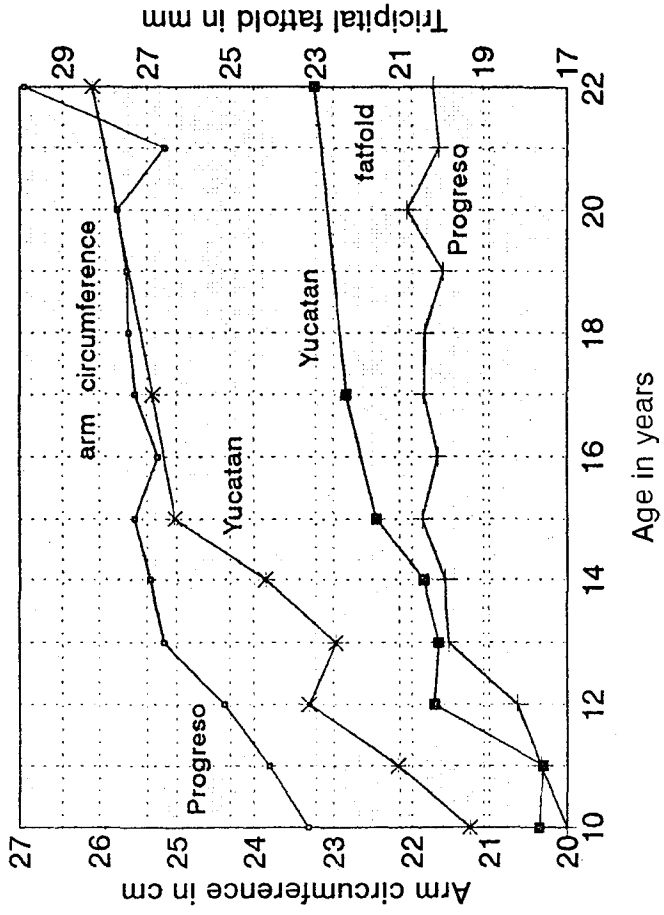

Figure 2. Mid-arm circumference and tricipital fatfold thickness *in Progreso menstruating girls in comparison with sample of Yucatan (M+P)*

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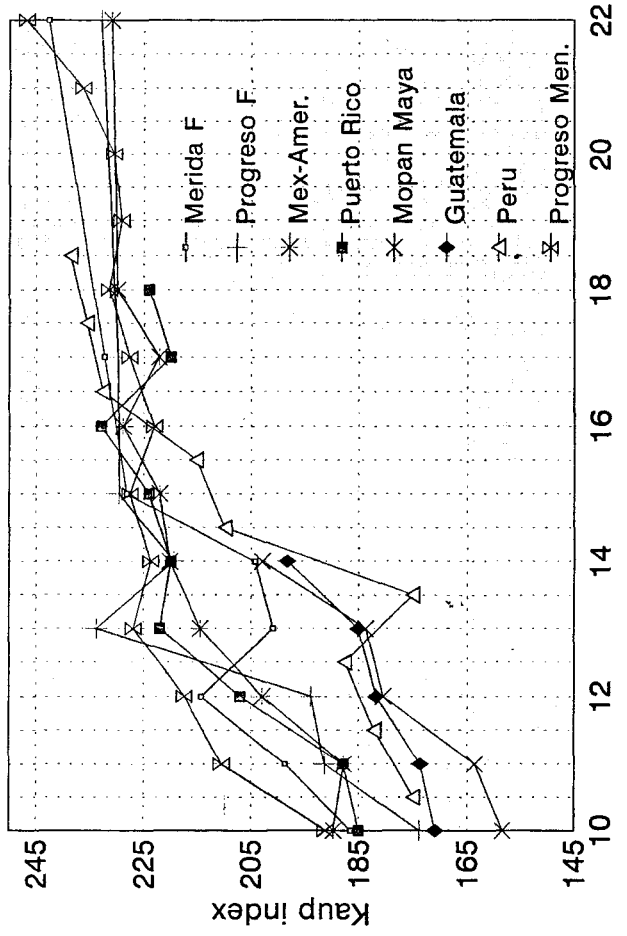

Figure 3. Kaup (Body Mass) index in girls from Progreso and Merida in comparison with Mexican American, Puerto Rican, Mopan Maya, Guatemala and Peru Indian

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The port in 1990 had 9 health centers. Of 8,200 houses 7,572 are supplied with potable water supply. 7,882 households had electricity and 5,248 had local septic tanks (INEGI 1993). 76.35% of coastal populations is living in Progreso (Rodriguez 1991). The main professional activities in 1990 included 2,665 fishing, 1,588 manufacture and 1,340 maintenance (INEGI 1993). In 1991-92 there were 1,019 births and 220 deaths (INEGI 1993). In 1990 this town had 37,806 inhabitants, 18,945 males and was growing by c. 15% per year. Over 100,000 people spent summer vacation in Progreso. In people of 15 years and older is 5.6% of illiterates in males and 8.4% in females. In Progreso are 13 schools of basic, medium and medium-superior level. Active socio-economically and professionally are 11,462 persons and 199 permanently unemployed.

Parent education was scored in a scale from 0-7 (0 = illiterate, 1 = not complete basic education, 2 = basic education, 4 = secondary, 6 = higher, and 7 = college degree); income was
based on monthly salary earned by the family in pesos (Table I).

Age of parents at birth of the particular girl under study was noted. This was done because the parents' experience and economic situation changes with age. Number of older and younger siblings, number of rooms in the house, number of fans, cars, bicycles, radios and TV sets were enumerated. It was also recorded how often read newspaper and how many books they had. To measure sanitary and living conditions the following were examined: source of water, garbage disposal, sanitary facilities, separate kitchen, possession of washer and refrigerator, house height, temperature and humidity. Finally migrations of ancestors (grandparents) was noted.

Using the Martin-Saller (1957) technique, somatic traits of girls were measured and age at menarche was established by the retrospective method.

The study follows a two-step analysis: the first step being a factor analysis (with Varimax rotation) of family characteristics. The second step involves a multiple regression of traits of girls in relation to family factors.

25 family traits were analyzed (Table II). 9 latent family factors were obtained which explained 54.5% of the variation in

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family characteristics (Table II). To obtain age-independent values for the offspring's traits, a 100-score T-scale was used (deviations from the arithmetic mean between -5 to +5 SD) for each age-and-sex-class separately. Multiple regression was applied to all girls' traits under study. Per cent of variance of a particular trait was calculated as a square of partial correlation.

Results and Discussion

As an average, the fathers of girls under study were born in 1949, and the mothers in 1952. Mean age of mother at childbirth was 24.9 (SD = 6.47) years. Duration of a generation in the studied population is about 25 years.

The mean values of somatic traits under study are presented in Table III. The comparison between Progreso menstruating girls and the sample of girls collected in Merida and Progreso during the whole-family studies (including girls who do not attend school, and also not menstruating) show interesting results. Menstruating girls ages 10-11 years old are taller than girls from the whole- family sample. Girls ages 18-21, are heavier (Figure 1), and girls aged 10-14 years have greater mid-arm circumference (Figure 2).

These results support Frisch's (1988) assertion that girls who accumulate more muscle tissue mature earlier. Both are probably related to higher hormonal activity. Tricipital fatfold thickness, on the other hand, was greater in the general sample than in menstruating girls from Progreso in all age classes (Figure 2).

All menstruating girls in Progreso attend school. These girls have also higher Kaup Index (BMI) than other comparable 10 to 14 year-olds from Yucatan, Puerto Rico, Belize, Guatemala and Peru (Figure 3). However, they become plumper at age 21.

Mean age at menarche in Progreso school girls (ages 1 years, SD = 2.62) was 12.11 and in their mothers (ages 41 years, SD = 6.88) was 12.51. In comparison with a smaller sample studied 4 years earlier (1989 - Table IV) the mothers' samples shows a some retardation, and daughters bigger sample acceleration by 0.1 year. In comparison with other Mexican samples age of menarche in girls from Progreso is in middle of the contemporary distribution.

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Table I. Mean values and SD of some traits of family and parents from Progreso

Variable	No	Mean	SD
Education of father in scores (1-7)	886	2.68	2.043
Education of mother in scores (1-7)	915	2.50	1.950
Monthly income of mother in pesos	1010	173.92	485.684
Monthly income of father in pesos	1010	947.44	848.446
Number of pregnancies of mother	994	4.90	2.456
Age of father at child birth in years	891	28.00	7.334
Age of mother at child birth in years	942	24.88	6.465
Age of mother at menarche of girls, years	942	37.00	6.626
No. of siblings younger than studied girl	1007	3.46	2.232
No. of siblings older than studied girl	981	1.84	2.069

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Table II. Factor analysis of household and family non-genetic traits in Mexican population. Progreso menarche study, 1993 (N = 1010 girls)

	FAC 1 Wealth	FAC 2 P.age	FAC 3 Sanit	FAC 4 Equip	FAC 5 Cultur	FAC 6 Educ.f	FAC 7 Electr	FAC 8 House	FAC 9 Humid
FANS No	.642	.015	.185	.335	.107	.061	.061	.031	.013
ROOMS No	.620	.077	.239	.158	-.050	.011	.065	.169	-.061
AUTO No	.594	-.065	.047	.176	.172	.171	-.060	.017	.003
INCOME F.	.562	-.046	.026	-.068	.103	.369	-.059	-.014	.021
NEWSPAPERS	.546	.078	.095	-.172	.005	-.098	.195	.206	.014
BICYCLE No	.491	-.036	-.327	.169	.055	-.251	.102	-.013	.046
AGE OF M	.013	.861	.027	-.004	.078	-.056	-.031	-.015	-.014
AGE OF F	-.020	.840	.047	.028	.046	.059	-.037	-.017	.088
SIBLINGS	.064	.455	-.361	-.152	-.170	-.056	.074	.069	-.334
GARBAGE	.082	.062	.622	.025	.034	.013	.040	.118	-.107
M.EDUCAT.	.229	-.109	.493	.084	.241	.259	-.022	.037	.017
SANIT.COND	.222	.036	.447	.393	-.175	-.113	.048	-.023	.057
REFRIGER N	.228	.006	.275	.672	.023	-.002	.115	-.010	.055
WASHER No	.090	-.051	-.108	.593	.002	.055	.227	.246	.025
INCOME M.	.042	.062	.137	-.033	.797	-.035	.066	.009	-.000
BOOKS No	.164	.022	-.048	.027	.744	.010	.019	.060	.013
MIGRATION	-.009	.043	-.042	.051	-.090	.771	.039	.088	-.056
F.ECUCAT.	.327	-.086	.290	-.036	.105	.591	-.048	-.038	.156
RADIO No	.024	.036	-.104	.227	.050	.109	.711	.100	.020
TV No	.071	-.049	.039	.136	.051	-.080	.615	-.095	-.105
WATER	.066	-.065	.353	-.363	-.046	-.038	.537	-.034	.196
HOUSE TEMP	.156	.060	-.051	-.103	-.010	-.097	-.065	.660	.238
HOUSE HEIG	-.043	.005	.045	.094	.002	.206	-.017	.587	-.111
KITCHEN	.159	-.080	.152	.175	.097	-.038	.051	.562	-.062
HOUSE HUMI	.007	.032	-.079	.048	-.004	.011	-.012	.019	.897
% of var. explained	14.2	+ 7.1	+ 6.2	+ 5.2	+ 4.9	+ 4.4	+ 4.3	+ 4.1	+ 4.0= =54.5%

Abbreviations: FANS = number (No) in home, ROOMS = No of rooms, AUTO = possesses (pos.) car, INCOME F. = income of father, NEWSPAPERS = how many read, BICYCLE = pos. bicycle, AGE OF M = age of mother at child birth and AGE OF F = of father, SIBLINGS = how many have siblings, GARBAGE = how collect, M.EDUCAT. = education of mother, SANIT.COND = household sanitary condition, REFRIGER = pos. refrigerator, WASHER = pos. washing machine, INCOME M. = income of mother, BOOKS = how many books have in home, MIGRATION = distance between birth place and present settlement, F.ECUCAT. = education of father, RADIO = pos. radio set, TV = pos. TV set, WATER = source of water, HOUSE TEMP = house hot or cold, HOUSE HEIG = height of rooms in cm, KITCHEN = kind of kitchen, HOUSE HUMI = humidity of house.

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Table III. Somatic traits in Progreso school girls in age 9-28 years
932 girls were in age 11-19 years.

Age in years	Body weight			Body height			Arm circumfer			Arm fatfold			Kaup index (BMI		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
9.0	21.50		1	119.80		1	18.00		1	12.00		1	149.80		1
10.0	38.66	7.1	5	141.56	6.3	5	23.32	3.4	5	17.00	3.5	5	191.18	21.1	5
11.0	44.72	7.0	28	145.60	5.8	28	23.81	2.2	28	17.63	4.1	28	210.45	28.5	28
12.0	47.27	10.1	91	147.05	6.6	91	24.38	2.9	91	18.19	4.8	91	217.44	36.2	91
13.0	49.38	11.2	140	147.27	5.9	140	25.17	3.3	140	19.83	5.6	140	226.92	45.4	140
14.0	50.37	9.7	184	149.86	5.7	184	25.35	2.7	184	19.93	5.0	184	223.74	36.9	184
15.0	51.35	9.8	146	149.89	5.4	146	25.55	2.7	146	20.47	4.8	146	227.56	35.1	146
16.0	50.25	8.4	134	150.00	5.5	134	25.25	2.6	134	20.09	5.0	134	223.10	34.1	134
17.0	51.92	9.2	98	150.99	5.4	98	25.54	2.9	98	20.42	5.3	98	227.66	38.0	98
18.0	53.27	9.9	70	151.63	5.7	70	25.63	2.9	70	20.41	5.3	70	231.39	38.9	70
19.0	52.89	9.1	54	151.85	5.6	54	25.65	2.8	54	19.96	5.8	54	229.19	36.1	54
20.0	53.34	8.0	18	151.95	6.2	18	25.77	2.4	18	20.83	6.1	18	230.56	28.8	18
21.0	55.79	9.0	14	153.59	5.4	14	25.17	2.1	14	20.07	5.0	14	236.40	33.3	14
22.0	54.90	8.9	10	149.33	6.9	10	26.94	2.7	10	20.20	2.7	10	246.85	42.3	10
23.0	62.18	7.2	6	153.42	6.7	6	27.85	2.7	6	26.67	2.0	6	265.51	38.7	6
24.0	56.75	1.8	2	154.25	.6	2	28.00	.3	2	28.00	2.8	2	238.55	9.4	2
25.0	72.06	16.7	5	155.74	6.8	5	30.16	3.7	5	27.80	5.6	5	295.52	56.6	5
26.0	49.00		1	153.00		1	22.30		1	19.00		1	209.32		1
27.0	53.20	1.1	2	155.50	3.5	2	25.90	3.0	2	21.00	7.1	2	220.29	14.7	2
28.0	50.00		1	148.20		1	28.20		1	25.00		1	227.65		1

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Table IV. Age at menarche in Mexican girls from various populations and groups. In some data (e.g. Kelley) mean age is probably incorrect because of mistaken calculation of mean age. For example a reported by girl mean age of 10 should be considered 10.5 since actual age of menarche may fall anywhere between 10.0 and 10.99. Legend: SD = standard deviation, if in parentheses = standard error, No = number of girls.

Population (author and year of publication)	Mean	SD	No
Oaxaca, valley (Malina et al. 1980)	14.50		258
Oaxaca, valley (Malina et al. 1980)	14.48	(0.34)	328
Oaxaca, urban colonia, low class (Malina et al. 1980)	14.45	(0.45)	160
Oaxaca, urban and rural colonia (Malina et al. 1977)	14.27	1.69	
Yucatan, rural Maya (Steggerda 1941)	12.91	(0.13)	42
Merida, urban, mothers, both Maya (Wolanski 1993)	12.85	1.46	47
Merida, urban (Diaz 1964)	12.83	1.00	736
Merida, Mestizo (Steggerda 1941)	12.81	(0.12)	83
Villa de Xochimilco, D.F. (Diaz el al 1968)	12.76	1.22	
Mexico City, Dist.Federal, urban (Pena 1970)	12.75	1.32	
Merida, urban (Diaz 1967)	12.61	1.44	
Merida, urban, all mothers (Wolanski 1993)	12.60	1.55	235
Merida, urban, mothers, both non-Maya (Wolanski 1993)	12.59	1.55	125
Mexico City, urban (Ramos 1963)	12.53	1.08	1608
Yucatan, rural Mayan (Kelley 1991), probably 13.22	12.52	1.12	111
Progreso, mothers of school girls, present studies	12.51	1.64	932
Tampico-Altamira, rural (Pena 1970)	12.41	1.64	42
Progreso, mothers of school girls, 1989 (Wolanski '93)	12.41		66
Merida, urban, daughters of both Maya parents,as above	12.38	1.19	91
Merida, urban, mothers, NM (Wolanski 1993)	12.36	1.51	72
Progreso, school girls, 1989 (Wolanski 1993)	12.24		135
District Federal, Mexico (Pena 1970)	12.19		182
Progreso, school girls, present studies	12.11	1.36	1010
Merida, urban, all daughters (Wolanski 1993)	12.09	1.36	473
Merida, urban,daughters of Maya-white parents,as above	12.05	1.42	151
Tampico, urban (Pena 1970)	12.03	1.28	162
Merida,urban, daughters both non-Maya parents,as above	11.98	1.38	227
Merida, urban Maya (Kelley 1991), probably 12.38	11.88	1.12	188

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Table V. Percent of variation of a given trait explained by fours family fact (culture + parental age + genetic + family size - see tables 2-13) in Yucate towns and Polish towns and villages populations in sons and daughters

Traits	Yucatan towns offspr.	Poland towns sons	Poland towns daught	Poland villag sons	Poland villag daught
stature (B-v)	27.39	11.04	8.94	11.56	10.85
body weight	10.07	4.70	4.18	3.63	4.66
triceps fatfold	0.27	2.47	2.49	2.16	2.50
arm circumference	2.91	0.15	0.22	-	-

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Table VI. Percent of variation of body height in offspring explained by genetic factor and sum of three non-genetic family factors (culture + parental age + family size) in some populations of Poland, Mexico, Japan and South Korea (Abbreviations: significant at * =.05, ** =.01, *** =.001 level).

Population	Genetic factor	Sum of 3 non-genetic factors
Poland, towns, sons	9.23***	1.81
Poland, towns, daughters	7.63***	1.31
Poland, villages, sons	11.04***	0.52
Poland, villages, daughters	10.67***	0.18
Mexico sons + daughters	22.10***	5.29
Japan, sons	12.64***	2.39
Japan, daughters	13.70***	1.09
Korea, sons****	1.81**	3.74
Korea daughters	13.30***	1.46

**** unknown reason of so low values

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Table VII. Multiple regression of body height and weight in relation to nine latent non-factors of parent and family

Factor	B	SE B	T	Sig T	% Var E	B	SE B	T	Sig T	% Var E
	Body Height					Body weight				
Wealth	1.069	.261	4.08	.000	1.551***	.903	.369	2.44	.014	.585**
Paren.age	.681	.261	2.60	.009	.630**	.429	.369	1.16	.245	.132
Hygiene	1.107	.261	4.23	.000	1.664***	.739	.369	2.00	.045	.392*
Equipm.	.770	.261	2.94	.003	.804**	.752	.369	2.03	.042	.406*
Culture	.196	.261	.75	.452	.052	.218	.369	.59	.555	.034
Educat.F	1.229	.261	4.69	.000	2.049***	.381	.369	1.03	.302	.104
Electric.	-.095	.261	-.36	.714	.012	.280	.369	.75	.448	.056
Temper.	.015	.261	.05	.953	.000	.082	.369	.22	.824	.004
Humidity	.509	.261	1.94	.051	.352*	.502	.369	1.35	.174	.180
(Cons)	44.023	.261	168.31	.000		51.280	.369	138.79	.000	

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Table VIII. Multiple regression of tricipital fatfold thickness and mid-arm circumference in relation to nine latent non-factors of parent and family

Factor	B	SE B	T	Sig T	%VarE	B	SE B	T	Sig T	% VarE
	Tricipital fatfold					Mid-arm circumfere				
Wealth	.357	.269	1.32	.185	.173	.625	.329	1.89	.058	.356′
Paren.age	-.235	.269	-.87	.382	.075	.276	.329	.83	.403	.069
Hygiene	.299	.269	1.11	.266	.121	.244	.329	.74	.459	.054
Equipm.	.023	.269	.08	.932	.000	.139	.329	.42	.672	.017
Culture	.045	.269	.16	.867	.002	.062	.329	.19	.849	.003
Educat.F	-.040	.269	-.14	.882	.002	-.148	.329	-.45	.652	.020
Electric.	.578	.269	2.14	.032	.454*	.386	.329	1.17	.241	.135
Temper.	.008	.269	.03	.976	.000	.291	.329	.88	.377	.077
Humidity	.511	.269	1.89	.058	.354′	.372	.329	1.12	.259	.126
(Cons)	57.854	.269	214.47	.000		53.032	.329	160.79	.000	

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Table IX. Multiple regression of age at menarche in relation to nine latent non-factors of parent and family

Factor	B	SE B	T	Sig T	% Var E
			Age at menarche		
Wealth	.003	.042	.07	.942	.000
Paren.age	.067	.042	1.58	.113	.247
Hygiene	-.058	.042	-1.37	.168	.187
Equipm.	.007	.042	.16	.867	.002
Culture	-.053	.042	-1.25	.208	.156
Educat.F	-.004	.042	-.10	.917	.001
Electric.	-.014	.042	-.33	.737	.011
Temper.	.026	.042	.61	.536	.037
Humidity	-.110	.042	-2.58	.010	.657**
(Cons)	12.112	.042	283.57	.000	

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The most important family latent factor is wealth (14.2% of the common variance), next parental age, sanitary conditions and main electric equipment (7.1-5.2%), 4.9 to 4% of the variation represents cultural level, father's education, electronic equipment, kind of house, and house humidity.

Because variation in traits such as stature is the result of different growth rate, we can say that per cent of variance of a trait explained by a particular factor means also dependence of growth of such trait from this factor.

In our previous Mexican sample the strongest dependence on family factors was stature (Table V). The genetic factor explained 22.1% of the total variance, but 3 other factors explained only 5.29%. Following was body weight with 2.37%, mid-arm circumference with 1.24%, and triceps fatfold with 0.27% explained by three non-genetic family factors.

In comparison with the Japanese, Korean and Polish data (Wolanski et al. 1994, Wolanski and Zaremba, 1995) body height in Mexican children (Wolanski and Siniarska 1995) is more dependent on four family factors (Table V). According to above studies three non-genetic factors (Table VI) depends in Japan and in Korea in 2% and in Poland in 1%. In all cases stronger dependence was in sons than in daughters.

In Progreso girls stature (Table VII) was explained in 7.3% by 9 factors (by sequence of variation was explained in F6 by parents' education, F3 hygiene, F1 wealth, F2 parental age and F9 house humidity), body weight (Table 7) in less than 2% (F1 wealth, F4 house equipment and F3 hygiene), tricipital fatfold (Table VIII) explained by factors of F7 electric equipment and F9 house humidity) and age at menarche (F9 house humidity) in less than 1% (Table IX).

Conclusions

In Progreso, girls' stature was explained in 7.3% by 9 latent factors (parents' education, hygiene, wealth, parental age and house humidity) representing 25 household and family non-genetic factors. Body weight in less than 2% (wealth, hygiene and house equipment) was explained by 9 factors, tricipital fatfold (electric equipment, house

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humidity) and age at menarche (house humidity) in c. 1%. Still, most of sources of variation were not explained by the factors under study. Probably more careful analysis of diet and style of life would explain more of the variance. Other factors were at that moment not clear.

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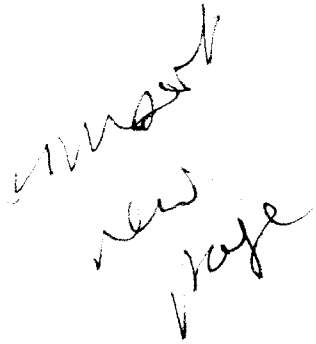

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Rates of Growth of Gypsy Children from Birth to One Year of Age Compared with Bulgarian Children

Maria Buchvarova
University of Plovdiv "P. Hilendarsky", Bulgaria

As is well known, the growth rates of children, particularly dynamic longitudinal research, has a number of uses. The continuous extended observations on one and the same group of children, thus accomplished, facilitates a more precise idea of the age dynamics of growth processes in the population as a whole.

There exist at least three papers offering information about longitudinal investigations, described in world literary sources (Nathaway, 1957; Heimendinger, 1964; Terada, 1965). The American authors (Meredith, 1935; Bayley, 1943, 1946, 1956; Boas, 1932; Maresh, 1955) have priority as far as this problem is concerned.

In Europe, longitudinal investigations multiplied after the end of World War II. The earliest studies were linked with the names of Tanner, 1962; Tanner, Healy, Lockhard, 1956; Hagen, 1962, 1966; Scholz, 1963; Schmid, 1965; Falkner, 1962; Salnikova, 1968; Vlastovskii, 1976. However, these and subsequent studies have been based on a comparatively small number of characteristics. Meanwhile, it is obvious that these studies in general do not provide sufficient data relating to racial, ethnic and temporal differences, thus leaving a need for much individual research in each separate country.

In Bulgaria investigations of this kind are definitely limited in number, and embrace children of Bulgarian origin only. The data, offered in the present paper, are the first of their kind to report on longitudinal measurements of female children of non-Bulgarian origin living in Bulgaria.

Materials and Methods

Our research studied 80 boys and 74 girls, subjected to observation from birth till one year of age. These were born in the town of Plovdiv and belonged to the so-called "Turkish gypsies", who

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profess Moslem faith and speak incorrect Turkish which contains numerous borrowings and admixtures from the Bulgarian language. This fact provides enough reason and justification to consider that they had originally settled in Bulgaria during the years of Ottoman domination.

The classical anthropometric variables for this kind of study, namely, body length (height), body weight, and chest circumference have been included in the study programme. The measurement methodology of Martn-Saller, 1956/57 has been used. An analysis of the variance of these characteristics relating to the absolute and the relative growth have been presented. This takes into consideration changes with age in Rohrer index and the existing differences in the general physical condition of Gypsy children and of Bulgarian ones (the data on the latter are according to B. Yanev et. al., 1982).

Results

In the age period examined we have observed a general tendency to intensive and reliable increase in body length, in weight and in chest circumference for both sexes. This development has led to an increase in height by 22.62 cm. for the boys and by 22.522 cm. for the girls in the course of the 12 months. The weight has increased by 6430 g. for the boys and by 9430 g. for the girls. The changes in chest circumference (just as in weight) have been almost identical by 13.74 cm and by 13.46 cm., respectively. The sexual dimorphism (with a predominance as far as the girls are concerned) is retained invariably until 12 months of age. The relative changeability of the characters decreases. The proportional share of the trunk in overall height has been increasing most intensively in the period 0 - 3 months, while the chest circumference decreases.

For the period analyzed, the growth rate of the essential anthropometric characters has followed a general tendency to decrease, while the percentage from their initial value has increased. The peak in growth rate of the trunk length for both sexes has been observed between the first and the second month of their postnatal development. The weight and the chest circumference have both exhibited a leap in growth, observed a month earlier, compared with height, while the girls have shown much more changeable rate in

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Table 1

STATISTICAL CHARACTERISTIC OF THE INDICATION STUDIED - BOYS.

Characters (Indication)	Age	Min-Max	x	s	m	Vs	% of height
Body length	0	48.0-53.0	50.28	1.35	0.16	2.68	-
	1	48.2-59.1	53.03	2.02	0.23	3.81	-
	2	51.2-62.8	56.55	2.25	0.25	3.98	-
	3	53.0-65.7	58.87	2.35	0.26	3.99	-
	4	55.0-67.0	61.06	2.23	0.25	3.65	-
	5	58.0-69.2	63.04	2.25	0.25	3.57	-
	6	59.9-71.3	64.75	2.33	0.26	3.60	-
	7	62.0-73.7	66.46	2.38	0.27	3.58	-
	8	63.2-75.0	68.08	2.41	0.27	3.54	-
	9	64.5-76.0	69.26	2.38	0.27	3.44	-
	10	66.0-77.0	70.66	2.30	0.26	3.25	-
	11	67.5-78.0	71.82	2.11	0.24	2.94	-
	12	68.6-79.0	72.90	2.21	0.25	3.03	-
Weight	0	2600- 4200	3340	0.45	0.05	13.47	6.64
	1	2800- 5200	4310	0.56	0.06	12.99	8.13
	2	3700- 6250	5080	0.62	0.07	12.20	8.98
	3	4050- 7400	5710	0.75	0.08	13.13	9.70
	4	4500- 8250	6320	0.79	0.09	12.50	10.35
	5	5000- 9000	6850	0.81	0.09	11.82	10.86
	6	5350- 9500	7290	0.85	0.10	11.66	11.26
	7	5500-10500	7730	0.91	0.10	11.77	11.63
	8	6050-10500	8160	0.80	0.09	9.80	11.99
	9	6600-10600	8570	0.86	0.10	10.04	12.37
	10	6950-11000	8940	0.85	0.09	9.51	12.65
	11	7600-11200	9310	0.85	0.01	9.13	12.96
	12	8050-11600	9770	0.78	0.09	7.98	13.40
Chest circumference	0	28.0-37.0	33.07	1.62	0.20	4.90	65.77
	1	31.0-40.0	36.44	1.78	0.20	4.88	68.72
	2	34.0-42.0	38.44	1.38	0.20	4.76	67.98
	3	35.0-44.0	39.56	1.81	0.20	4.58	67.20
	4	36.0-45.0	40.55	1.80	0.20	4.44	66.41
	5	37.0-46.0	41.49	1.80	0.20	4.34	65.82
	6	38.0-47.0	42.34	1.78	0.20	4.20	65.39
	7	39.0-48.0	43.16	1.73	0.19	4.00	64.94
	8	40.0-49.0	44.09	1.74	0.19	3.95	64.75
	9	41.0-49.6	44.41	1.57	0.18	3.54	64.12
	10	42.0-50.0	45.35	1.65	0.18	3.64	64.18
	11	43.0-50.5	46.13	1.57	0.18	3.40	64.23
	12	44.0-51.0	46.81	1.58	0.18	3.38	64.21

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Table 2

STATISTICAL CHARACTERISTIC OF THE INDICATION STUDIED - GIRLS.

Characters (Indication)	Age	Min-Max	x	s	m	Vs	% of height
Body length	0	45.0-53.0	49.26	1.70	0.20	3.45	-
	1	48.0-57.0	52.02	2.14	0.26	4.11	-
	2	50.9-61.0	56.26	2.14	0.25	3.80	-
	3	53.0-64.1	57.95	2.06	0.24	3.55	-
	4	55.0-66.8	60.11	2.09	0.24	3.48	-
	5	57.5-68.1	62.09	2.14	0.25	3.45	-
	6	58.5-70.0	63.92	2.19	0.25	3.43	-
	7	59.5-72.0	65.49	2.30	0.27	3.51	-
	8	61.0-73.6	67.12	2.28	0.26	3.40	-
	9	62.0-75.0	68.50	2.30	0.27	3.36	-
	10	63.3-76.2	69.64	2.27	0.26	3.26	-
	11	64.5-77.2	70.85	2.22	0.26	3.13	-
	12	65.5-78.3	71.78	2.28	0.27	3.18	-
Weight	0	2300- 4000	3190	0.41	0.05	12.85	6.48
	1	2650- 5350	4060	0.53	0.06	13.05	7.80
	2	3250- 6200	4720	0.59	0.07	12.50	8.39
	3	3800- 7000	5260	0.65	0.08	12.36	9.08
	4	4050- 8000	5860	0.74	0.09	12.63	9.75
	5	4500- 9000	6330	0.75	0.09	11.85	10.19
	6	5200- 9500	6720	0.78	0.09	11.61	12.20
	7	5660-10000	7160	0.77	0.09	10.75	10.93
	8	5800-10500	7600	0.79	0.09	10.39	11.32
	9	9050-11000	8040	0.78	0.09	9.70	11.74
	10	6400-11200	8400	0.82	0.10	9.76	12.06
	11	6600-11350	8830	0.79	0.09	8.95	12.46
	12	7500-11500	9430	0.78	0.09	8.27	13.14
Chest circumference	0	29.0-36.0	32.43	1.34	0.16	4.13	65.84
	1	32.0-39.0	35.45	1.61	0.19	4.54	68.15
	2	34.0-41.0	37.47	1.56	0.18	4.16	66.60
	3	35.0-42.0	38.47	1.51	0.18	3.93	57.95
	4	36.0-43.0	39.47	1.55	0.18	3.93	65.66
	5	37.0-44.0	40.49	1.50	0.17	3.70	65.21
	6	38.0-45.0	41.36	1.45	0.17	3.51	64.71
	7	39.0-45.5	42.27	1.36	0.16	3.22	64.57
	8	40.0-46.0	43.12	1.30	0.15	3.01	64.24
	9	41.0-46.5	43.85	1.23	0.14	2.81	64.01
	10	42.0-47.0	44.59	1.20	0.14	2.69	64.03
	11	43.0-47.5	45.19	1.16	0.13	2.57	63.78
	12	43.5-48.0	45.89	1.09	0.13	2.38	63.93

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Table 3

SEX DIMORPHISM.

Characters (Indication)	Age	boys		girls		t
		$\bar{x}$	m	x	m	
Body length	0	50.28	0.16	49.26	0.20	3.98
	1	53.03	0.23	52.02	0.26	2.91
	2	56.55	0.25	56.26	0.25	0.82
	3	58.87	0.26	57.95	0.24	2.60
	4	61.06	0.25	60.11	0.24	2.74
	5	63.04	0.25	62.09	0.25	2.88
	6	64.75	0.26	63.92	0.25	2.31
	7	66.46	0.27	65.49	0.27	2.54
	8	68.08	0.27	67.12	0.26	2.56
	9	69.26	0.27	68.50	0.27	1.99
	10	70.66	0.26	69.64	0.26	2.77
	11	71.82	0.24	70.85	0.26	2.74
	12	72.90	0.25	71.78	0.27	3.04
Weight	0	3340	0.05	3190	0.05	2.14
	1	4310	0.06	4060	0.06	3.14
	2	5080	0.07	4720	0.07	3.60
	3	5710	0.08	5260	0.08	4.09
	4	6320	0.09	5860	0.09	3.54
	5	6850	0.08	6330	0.09	4.00
	6	7290	0.10	6720	0.09	4.38
	7	7730	0.10	7160	0.09	4.38
	8	8160	0.09	7600	0.09	4.31
	9	8570	0.10	8040	0.09	4.08
	10	8940	0.09	8400	0.10	4.15
	11	9310	0.01	8830	0.09	3.69
	12	9770	0.09	9430	0.09	2.62
Chest circumference	0	33.07	0.20	32.43	0.16	2.46
	1	36.44	0.20	35.45	0.19	3.54
	2	38.44	0.20	37.47	0.18	3.59
	3	39.56	0.20	38.47	0.18	4.03
	4	40.55	0.20	39.47	0.18	4.00
	5	41.49	0.20	40.49	0.17	3.85
	6	42.34	0.20	41.36	0.17	3.77
	7	43.16	0.19	42.27	0.16	3.56
	8	44.09	0.19	43.12	0.15	4.04
	9	44.41	0.18	43.85	0.14	2.44
	10	45.35	0.18	44.59	0.14	3.30
	11	46.13	0.18	45.19	0.13	4.27
	12	46.81	0.18	45.89	0.13	4.19

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Table 4

GROWTH OF MAIN SOMATOMETRIC INDICATIONS - BOYS

Characters (Indication)	Age	% of initial value	Relative growth	Absolute growth	t
Body length	1	105.47	12.16	2.57	9.48
	2	112.47	15.56	3.52	10.67
	3	117.08	10.26	2.32	6.44
	4	121.44	9.68	2.19	6.08
	5	125.38	8.75	1.98	5.66
	6	128.78	7.56	1.71	4.75
	7	132.18	7.56	1.71	4.62
	8	135.40	7.16	1.62	4.38
	9	137.75	5.22	1.18	3.19
	10	140.53	6.19	1.40	3.78
	11	142.84	5.31	1.20	3.22
	12	144.99	4.77	1.08	3.09
Weight	1	129.04	15.09	0.970	12.44
	2	152.10	11.98	0.770	8.37
	3	170.96	9.79	0.630	5.73
	4	189.22	9.49	0.610	5.08
	5	205.05	8.24	0.530	4.08
	6	218.26	6.84	0.440	3.38
	7	231.44	6.84	0.440	3.15
	8	244.31	6.68	0.430	3.31
	9	256.59	6.38	0.410	3.15
	10	267.66	5.75	0.370	2.85
	11	278.74	5.75	0.370	4.11
	12	292.51	7.15	0.460	5.11
Chest circumference	1	110.19	24.53	3.37	12.04
	2	116.24	14.56	2.00	7.14
	3	119.63	8.15	1.12	4.00
	4	122.62	7.21	0.99	3.54
	5	125.46	6.84	0.94	3.36
	6	128.03	6.19	0.85	3.04
	7	130.51	5.97	0.82	2.98
	8	133.32	6.77	0.93	3.44
	9	134.29	2.33	0.32	1.23
	10	137.13	6.84	0.94	3.76
	11	139.49	5.68	0.78	3.12
	12	141.55	4.95	0.68	2.72

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Table 5

GROWTH OF MAIN SOMATOMETRIC INDICATIONS - GIRLS

Characters (Indication)	Age	% of initial value	Relative growth	Absolute growth	t
Body length	1	105.60	12.26	2.76	8.36
	2	114.21	18.83	4.24	11.78
	3	117.64	7.50	1.69	4.97
	4	122.03	9.59	2.16	6.35
	5	126.05	8.92	1.98	5.82
	6	129.76	8.13	1.83	5.23
	7	132.95	6.97	1.57	4.36
	8	136.26	7.24	1.63	4.41
	9	139.06	6.13	1.38	3.73
	10	141.37	5.06	1.14	3.08
	11	143.83	5.37	1.21	3.27
	12	145.72	4.13	0.93	2.51
Weight	1	127.27	13.94	0.870	11.15
	2	147.96	10.58	0.660	7.17
	3	164.89	8.65	0.540	5.09
	4	183.70	9.63	0.600	5.00
	5	198.43	7.53	0.470	3.70
	6	210.66	6.25	0.390	3.07
	7	224.45	7.05	0.440	3.46
	8	238.24	7.05	0.440	3.46
	9	252.04	7.05	0.440	3.46
	10	263.32	5.77	0.360	2.68
	11	276.80	6.89	0.430	3.20
	12	295.61	9.62	0.600	4.72
Chest circumference	1	109.31	22.44	3.02	12.18
	2	115.54	15.01	2.02	7.71
	3	118.66	7.43	1.00	3.92
	4	121.71	7.43	1.00	3.92
	5	124.85	7.46	1.02	4.11
	6	127.54	6.46	0.87	3.63
	7	130.34	6.76	0.91	3.89
	8	132.96	6.32	0.85	3.88
	9	135.21	5.42	0.73	3.56
	10	137.50	5.50	0.74	3.74
	11	139.35	4.46	0.60	3.14
	12	141.50	5.20	0.70	3.80

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Table 6

STATISTICAL CHARACTERISTIC OF ROHRER INDEX-BOYS

Characters (Indication)	Age	Min-Max	x	s	m	Vs	t
Rohrer index	0	2.29-3.14	2.70	0.22	0.03	8.15	6.25
	1	2.28-3.54	2.95	0.28	0.03	9.49	1.00
	2	2.26-3.90	2.91	0.31	0.03	10.65	0.60
	3	2.21-3.62	2.88	0.33	0.04	11.46	0.33
	4	2.14-3.85	2.86	0.34	0.04	11.89	1.00
	5	2.10-3.57	2.80	0.32	0.04	11.43	0.80
	6	2.07-3.49	2.76	0.31	0.03	11.23	1.25
	7	2.04-3.24	2.71	0.31	0.03	11.44	0.50
	8	2.10-3.40	2.69	0.27	0.03	10.04	0.75
	9	2.06-3.37	2.66	0.26	0.03	9.77	1.50
	10	2.02-3.23	2.60	0.24	0.03	9.23	0.25
	11	2.10-3.06	2.59	0.23	0.03	8.88	0.25
	12	2.15-3.04	2.60	0.23	0.03	8.85	

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Table 7

STATISTICAL CHARACTERISTIC OF ROHRER INDEX-GIRLS

Characters (Indication)	Age	Min-Max	$\bar{x}$	s	m	Vs	t
	0.	2.08-3.23	2.67	0.22	0.03	8.24	
							0.25
	1	1.80-3.53	2.64	0.27	0.03	10.22	
							4.25
	2	1.80-3.36	2.81	0.29	0.03	10.32	
							0.25
	3	1.86-3.33	2.82	0.28	0.03	9.93	
							1.00
	4	1.77-3.43	2.78	0.30	0.03	10.79	
							1.50
	5	1.76-3.46	2.72	0.30	0.03	11.03	
							1.25
Rohrer index	6	1.90-3.44	2.67	0.28	0.03	10.49	
							0.50
	7	1.87-3.35	2.65	0.28	0.03	10.57	
							1.25
	8	1.79-3.10	2.60	0.25	0.03	9.62	
							1.00
	9	1.87-3.05	2.56	0.23	0.03	8.98	
							0.25
	10	1.88-3.04	2.55	0.22	0.03	8.63	
							0.50
	11	1.86-3.02	2.57	0.21	0.02	8.17	
							1.00
	12	1.85-3.16	2.60	0.22	0.03	8.43	

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Table 8

COMPARATIVE CHARACTERISTIC IN RELATION TO DATA FROM THE COUNTRY-BOYS

Characters (Indication)	Age	Bulgarian children		Children of gipsy origin		t
		$\bar{x}$	m	$\bar{x}$	m	
Body length	0	52.70	0.1	50.28	0.16	12.74
	1	56.60	0.1	53.03	0.23	14.28
	2	60.00	0.1	56.55	0.25	12.78
	3	63.20	0.4	58.87	0.26	9.02
	4	65.00	0.2	61.06	0.25	12.31
	5	67.50	0.3	63.04	0.25	11.44
	6	69.10	0.3	64.75	0.26	10.88
	7	70.50	0.2	66.46	0.27	10.47
	8	71.90	0.1	68.08	0.27	13.17
	9	73.00	0.3	69.26	0.27	9.35
	10	75.10	0.4	70.66	0.26	9.25
	11	75.50	0.4	71.82	0.24	7.83
	12	77.50	0.2	72.90	0.25	14.38
Weight	0	3.9	0.1	3.340	0.05	5.09
	1	4.8	0.1	4.310	0.06	4.08
	2	5.7	0.0	5.080	0.07	8.86
	3	6.5	0.1	5.710	0.08	6.08
	4	7.2	0.1	6.320	0.09	6.77
	5	7.9	0.1	6.850	0.09	8.08
	6	8.3	0.1	7.290	0.10	7.21
	7	8.8	0.1	7.730	0.10	7.64
	8	9.2	0.1	8.160	0.09	8.00
	9	9.5	0.1	8.570	0.10	6.64
	10	10.0	0.1	8.940	0.09	8.15
	11	10.0	0.1	9.310	0.01	6.90
	12	10.6	0.1	9.770	0.09	6.38
Chest circumference	0	35.5	0.2	33.07	0.20	8.68
	1	38.0	0.1	36.44	0.20	7.09
	2	40.4	0.1	38.44	0.20	8.91
	3	41.9	0.1	39.56	0.20	10.64
	4	43.0	0.2	40.55	0.20	8.75
	5	44.4	0.1	41.49	0.20	13.23
	6	44.8	0.1	42.34	0.20	11.18
	7	45.8	0.2	43.16	0.19	9.43
	8	46.2	0.2	44.09	0.19	3.98
	9	46.8	0.2	44.41	0.18	8.85
	10	47.4	0.1	44.35	0.18	9.76
	11	47.4	0.1	46.13	0.18	6.05
	12	48.0	0.2	46.81	0.18	4.41

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Table 9

COMPARATIVE CHARACTERISTIC IN RELATION TO DATA FROM THE COUNTRY-GIRLS

Characters (Indication)	Age	Bulgarian children		Children of gipsy origin		t
		$\bar{x}$	m	$\bar{x}$	m	
Body length	0	51.7	0.2	49.26	0.20	8.71
	1	55.4	0.2	52.02	0.26	10.24
	2	58.9	0.1	56.26	0.25	9.78
	3	61.9	0.2	57.95	0.24	12.74
	4	63.8	0.4	60.11	0.24	7.85
	5	65.6	0.1	62.09	0.25	13.00
	6	67.6	0.3	63.92	0.25	9.44
	7	68.7	0.2	65.49	0.27	9.44
	8	70.1	0.3	67.12	0.26	7.45
	9	71.8	0.2	68.50	0.27	9.71
	10	72.7	0.1	69.64	0.26	10.83
	11	74.0	0.2	70.85	0.26	9.55
	12	75.4	0.3	71.78	0.27	9.05
Weight	0	3.6	0.5	3.190	0.05	0.82
	1	4.5	0.0	4.060	0.06	7.33
	2	5.4	0.0	4.720	0.07	9.71
	3	6.1	0.0	5.260	0.08	10.50
	4	6.7	0.1	5.860	0.09	6.46
	5	7.3	0.0	5.330	0.09	21.89
	6	7.8	0.1	6.720	0.09	8.31
	7	8.2	0.1	7.160	0.09	8.00
	8	8.6	0.1	7.600	0.09	7.69
	9	8.9	0.1	8.040	0.09	6.62
	10	9.2	0.1	8.400	0.10	5.71
	11	9.4	0.1	8.830	0.09	5.38
	12	9.9	0.1	9.430	0.09	3.62
Chest circumference	0	34.5	0.3	32.43	0.16	6.09
	1	37.5	0.2	35.45	0.19	7.32
	2	39.2	0.1	37.47	0.18	8.24
	3	40.8	0.1	38.47	0.18	11.10
	4	42.1	0.1	39.47	0.18	12.52
	5	43.1	0.1	40.49	0.17	13.05
	6	43.9	0.2	41.36	0.17	9.77
	7	44.5	0.1	42.27	0.16	11.74
	8	45.2	0.2	43.12	0.15	8.32
	9	45.6	0.1	43.85	0.14	10.29
	10	45.9	0.2	44.59	0.14	5.46
	11	46.3	0.3	45.19	0.13	3.36
	12	47.0	0.3	45.89	0.13	3.36

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weight increase, which after the 6th month exceeds that of the boys and influences the percentage of its initial value. The checking processes have been more pronounced with the boys and, generally could be assigned to the period 6th - 8th month.

The new-born boys and girls have identical values for the Rohrer index, then a sharp increase is observed embracing the first three months. This process corresponds in time to the intensive growth of body length and weight which is more pronounced with the boys. As early as the third month a slow but permanent tendency to decrease the values has started, thus imparting the idea of relative slimming of the children with the changes in age. At the age of 12 months the index has again reached its initial values.

We could state as a general conclusion that the growth processes, concerning the essential anthropometric characters with children of gypsy origin follow the classical tendency of manifestation. The quantitative changes caused by them, however, as a whole as worse than that of Bulgarian children. The existing differences have been established as early as the moment of birth and are invariable retained till the 12th month. The children of gypsy origin lag behind in increasing body length by an average of 4.04 cm with the boy and by 3.35 cm with the girls. The difference is the smallest, concerning the mean values of newborn babies. With one and the same initial difference in the mean values for height for both sexes, in the processes of growing the difference becomes almost twice as large with the Bulgarian children, compared with the gypsy ones. The boys of gypsy origin lag behind in terms of their weight with an average of 946 g., while the figure for the girls is 843 g.

The difference in the mean values for the two ethnic groups starts to increase from the 2nd month on, reaching its maximum in the 5th month for the girls, and in the 10th month for the boys. At the age of 10 months the weight of the gypsy boys is by 1060 g. less than that of the Bulgarian boys of the same age.

In our opinion, these peculiarities are probably due to two factors – the genetic fund and the nutrition characteristics of children examined.

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Biological Diversity and Ethnic Identity: Changing Patterns in the Modern World

J. W. Jamieson
Institute for the Study of Man

Evolution expresses itself in two major biological processes. One is a tendency toward passive adaptation to prevailing environmental conditions, and the other is a trend toward increasing biological complexity that permits organisms in specific phylogenetic continuua to vary their response to changes in the environment in a manner which will facilitate their ability to survive and produce future generations. The combined result is adaptive radiation resulting in what we call speciation.

In the case of the higher animals, the increasing ability to respond to changes in the environment took the form of increased mobility and an enhanced ability to detect what was taking place in the environment. In the case of the hominids and manlike creatures, it specifically resulted in selection in favor of higher intelligence: that is to say, an enhanced ability to analyze the information received from the sensory organisms and with the aid of memory to devise appropriate survival-oriented responses. The hominid brain expanded at a remarkable rate in the past million years, more than doubling by the time of the emergence of the first *Homo sapiens sapiens* some forty thousand years ago.[1] As Ernst Mayr wrote, "The most astounding phenomenon of human evolution is the rapid increase in brain size since the Pleistocene."[2]

Intelligence led to tool-making, and eventually to a situation which has made humankind dominant over virtually the entire organic world. However, since the introduction of agriculture about ten

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[1] George R. Harrison, *What Man Might Be*. p. 263, New York: Morrow, 1956.

[2] Ernest Mayr, *Animal Species and Evolution*, p. 650. Cambridge: Harvard University Press, 1963.

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thousand years ago, mankind has multiplied enormously in numbers, but has also been devolving in certain ways. It is arguable that the decrease in the size of the brain, when the Cro-Magnons are compared with the diverse living peoples of today's world, may indicate a decline in intelligence. Let us see how this may have occurred.

To do so we need to return to our overview of evolution. Since man is but a product of evolutionary forces, the variety of different directions in which organisms may develop as a result of these two main trends, notably passive adaptation and an ability to develop positive survival-oriented responses to changes in the environment has resulted in speciation. A species has been defined as a phylogenetic continuum that has become so differentiated that it has lost the ability to procreate with other life forms that have taken different evolutionary courses. At some point in its evolution every species has to have passed through a stage known as subspeciation, when it constituted a population that was beginning to evolve in a new direction but still had not lost the ability to procreate with other populations of similar ancestral origin. The emergence of different subspecies would generally be due to geographical isolation under different environmental selective forces. No speciation can take place if emerging subspecies lose their identity by merging their genes with other related subspecies before they have become so differentiated that they have lost the ability to cross-breed, or in other words have evolved into different species. Genetic isolation is an essential prerequisite for evolutionary speciation.

In the case of the more complex, more mobile animals, a problem arises. Geographical isolation is not always effective in their case, and newly emerging, mobile subspecies may come into contact with related subspecies. If they were to substantially mingle their genes, the evolutionary experiment would be brought to an end. No new separate subspecies would have a chance to evolve into new species.

As G. G. Simpson[3] early pointed out, and no evidence has since come to life to controvert this, in feral conditions, behavioral

[3] G. G. Simpson, *The Meaning of Evolution*. New York: Oxford University Pres, 1949.

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tendencies frequently arise which discourage attempts at cross-breeding between subspecies. He suggested that feral constraints may arise which discourage such subspecies from attempting to crossbreed with each other, thus making further speciation possible. These may take the form of biological constraints, based on differences in physical factors such as color, shape or smell, or acquired, constraints, such as intellectual "prejudices" in favor of the organisms own kind. Simpson suggested that these detectable differences in visual appearance, body odor, or behavior operate in feral conditions like a yellow flag hoisted aboard a ship carrying disease, as it enters harbor: warning other ships or subspecies "Danger, stay away, a new evolutionary experiment is in progress here."

In the course of hominid evolution many populations or subspecies simply died out, or gave up control over their territories to other groups better equipped to survive. But the existing hominid subspecies of today never reached the level of specific differentiation when they would have lost the biological ability to crossbreed with each other. However, they have still possess an element of the ethnic consciousness that once warned their forebears to against crossbreeding with other subspecies. Indeed, if the mitochondrial DNA theory is correct, then the ancestors of all modern human peoples avoided crossbreeding with other less evolved hominid and hominoid lineages. It is difficult to believe that *Homo sapiens sapiens* sprang spontaneously into existence as a full-fledged species, biological incapable of cross-procreation with other hominid or hominoid populations with whom they must have had contact – and the fossil record indicates that many very different evolving populations of hominoids and hominids occupied the earth contemporaneously (e.g. *Australopithecines* and *Homo habilis.* It may therefore be likely that from an early date they were restrained by Simpson's biological and intellectual constraints against crossbreeding, having an inbred reluctance to intermingle with subspecies at lower levels of evolution, and had already developed a sense of what we would today call "prejudice" – an awareness of "ethnic identity."

At the hunting and gathering level of subsistence, band type *Homo sapiens* societies may be supposed to have felt little ethnic difference between their own band and neighboring bands. They therefore intermingled genes with their local neighbors and biological

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diversification or subspeciation would have taken the form of genetic clines or gradients which reflected the prevailing selective forces in the local geographical environment over large areas. Thus, biologically and culturally, hunters in the Northern parts of Eurasia during the Würm glaciation evolved differently from hunters and gatherers who remained in the more favorable conditions of the tropical and subtropical zones of human occupation. Among other things, there may well have been an increased selection in favor of the higher intelligence required to obtain food by hunting the large mammals which were a prime source of food in more northerly climates. This is evidenced by the increasing size of the brain case, and by the changing shape as the lower areas such as the mesencephalon, already present in reptiles, became proportionately smaller to the whole brain, while the frontal lobes, the cerebrum, and the limbic cortex develop and increase in size.[4]

Even since the earliest hunting and gathering hominoid societies, we believe that man's ancestors, like most other mammals and even birds, had developed some form of territoriality, and with territorially-based groups or bands altruism would have likely developed. Both territoriality and altruism were conducive to group survival, aiding the survival of the breeding population. Those hominoids which did not develop these behavioral tendencies would be less likely to survive. The term "altruism" is here used to refer to behavior by any individual member of a group which serves to promote the survival chances of the group even at the risk to the individual's own survival or procreative chances, for what matters in evolution is the survival of the phylogenetic continuum, not of the individual. However, with the coming of agricultural, pastoral, and advanced fishing communities, an increase in population eventually led to increased competition between groups for the resources necessary to facilitate survival and successful procreation. There was also the possibility that some populations would become dominant

[4] See "Evolution and Hominization" by F. J. Irsigler, *The Mankind Quarterly*, 21,3;211-225. In short, as hominid evolution is marked by an increase in the ability to reason and a more powerful regulation of impulsive, unreasoned behavior. It is arguable that the modern races differ markedly in both these qualities.

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over others, and that different stocks would come to be incorporated into the same territorially-based society, without necessarily blending their genes. Evolutionary prejudices could have prevented or restricted this, in the form of often quite sophisticated restraints, such as the Brahmanical caste system.

In short, among more complex, advanced and mobile life forms, selection takes place not only in the form of competition between individuals within a breeding population to reproduce, but also competition to reproduce between different breeding populations. This does not necessarily involve violent conflict; often it is merely competition to control the resources necessary for intergenerational survival. This resulted at the Mammalian level of evolution in a number of complex patterns of behavior such as territoriality, altruism, and at some time after the appearance of hominids, a strong sense of loyalty to the breeding population – what we would today call a sense of "ethnic identity." A sense of ethnicity or group identity was an automatic concomitant to effective altruistic behavior (often demanding the life of the altruistic individual) if the survival chances of the gene pool are to be enhanced by altruism. Contrariwise, altruistic behavior which aided the survival chances of competing groups would be self-defeating and dysgenic.

Altruism, whereby the individual promotes the survival of his or her group, enhances the survival chances of the breeding population, as also does a sense of group identity. Furthermore. altruism and a sense of ethnic identity or group loyalty were mutually supportive because and enhanced mutual cooperation within the group. Evolution was not based solely on competition between individuals: it clearly involved intergroup competition to reproduce and to raise the resultant progeny to the level when they could produce a further generation. A strong sense of ethnic identity would have played an important role in survival at the Hominid level.

In more modern societies, greatly enhanced opportunities for extended communication and for travel beyond the geographical limits of the individual's own "breeding ground" have operated to negate the traditional pattern of altruism and breeding. Instead of the band or immediate breeding population representing the individual's community and total society, the inhabitants of modernized Western societies have increasingly come to perceive the entire population of

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the world as a part of a single community, and even of a single society. Whether this is an entirely correct perception or not, the result has been a shift of altruism away from its former in-group directed evolutionary limits and function to embrace peoples of all populations around the world. Indeed, more sympathy can sometimes be felt for the suffering of alien populations with whom the individual has never had contact than for the concerns of his or her next door neighbor, with whom past tensions may have created a certain degree of conflict.

In consequence, ethnic identity has become a less powerful force than formerly, and as a result altruism often results, through government financial aid and voluntary organizations in the redirection of resources away from the altruist's own genetic group toward subsidizing a vast increase in the numbers of what were formerly considered competing populations. A group which directs its altruism to the benefit *rival* groups weakens its own chances in the demographic struggle for scarce resources. But could an extension of altruism to embrace the entire world population possibly bring peace and cooperation to an increasingly overcrowded world? Perhaps not. The problem is that as Garrett Hardin has pointed out

> In the absence of competition between tribes the survival value of altruism in a crowded world approaches zero because what ego gives up necessarily goes into the commons. What is in the commons cannot favor the survival of the sharing impulses that put it there unless limits are placed on sharing [on who is to benefit from the altruistic urge]. To place limits on sharing is to create a tribe ... A state of One World [universal society], if achieved, would soon redissolve into an assemblage of tribes."[5]

Ethnicity is unlikely to disappear, according to Hardin, because the pressure of population that is currently breaking down tribal barriers will in course of time create conditions in which some

[5] Garrett Hardin, *The Limits of Altruism: An ecologist's view of survival.* Indiana University Press, 1977. p. 132.

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of the existing groups will rediscover their identify and seek to protect themselves by limiting their altruism to their own group, failing which new groups will form and evolutionary speciation will continue one way or another. The only question is: how many thousands of generations of evolutionary speciation will be lost in the intervening period of genetic panmixia?

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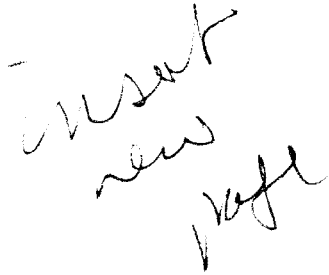

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Book Review Article

The Nature of Criminality

Kevin Lamb

Genetics of Criminal
& Antisocial Behaviour
(ed.) Sir Michael Rutter
Wiley, 1996 238 pp. $79.95

The results of the Minnesota Study of Twins that *Science* published six years ago obscured a brief but provocative editorial. In "The Rational Approach to the Irrational," *Science* editor Daniel Koshland argued that society would have to look beyond popular sociological explanations of predatory behavior in order to fully understand the sources of violent crime. Further genetic research, Koshland noted, may eventually explain *how* nature and nurture interact to cause aberrant behavior;

> Homicidal maniacs have appeared in all cultures over the entire length of human history. Society's modern response to their chaotic behavior has most often been a diligent search for their childhoods, as though understanding their up bringing and circumstances would explain their aberrant actions. There is nothing wrong with that kind of investigation, and in some cases history and environment will reveal clues. However, it is time the world recognized that the brain is an organ like other organs--like the kidney, the lung, the heart--and that it can go wrong not only as the result of abuse, but also because of hereditary defects utterly unrelated to environmental influences. Some inherent defects may be exacerbated by environmental conditions, but the irrational output of a faulty brain is like the faulty wiring of a computer, in which failure is caused not by the information fed into the computer, but by incorrect processing of that information after it enters the black box.[1]

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[1]Koshland, Daniel "The Rational Approach to the Irrational" *Science* October 12, 1990, p. 189.

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In another *Science* editorial, Koshland argues that the nature/nurture issue concerning human behavior is no longer in dispute. A growing amount of empirical evidence from the behavioral sciences, most notably research from twin and adoption studies, shows that in addition to environmental factors genes significantly influence human behavior. As Koshland points out, researchers have provided an abundance of corroborating evidence to substantiate this claim.[2] By applying new theoretical insights and analytical methods to data from twin and adoption studies, behavioral geneticists have cultivated a perceptive understanding of human conduct. These researchers have developed a comprehensive analysis of individual differences by clarifying the intricate relationship between nature and nurture in behavioral traits. A bio-social approach can explain the causal roles of social and biological factors when sociological theories at best strictly account for social elements. But what explains the underlying causes of these social factors? For the most part, superficial arguments and circular reasoning dominate sociological explanations; social theories *alone* merely *describe* social phenomenon.

The work of behavior geneticists inevitably attracts the ire of egalitarian critics, namely social scientists who disregard genetic research and adhere to the dogma of cultural relativism. The idea that genes *influence* human behavior, particularly anti-social or violent behavior, remains unacceptable for many of these social scientists. In his 1993 book *The Decomposition of Sociology*, Irving Louis Horowitz, Hannah Arendt Distinguished Professor of Sociology and Political Science at Rutgers University, depicts the essence of this prevailing egalitarian trend within the social sciences;

> A fascinating illustration of how egalitarian modalities became dominant in social science is in the area of criminology. Far from the late nineteenth-century tradition that sought to indicate how the behaviors of criminals differed from those of other citizens, the new criminology took the position that criminals are

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[2]Koshland, Daniel "Nature, Nurture, and Behavior" *Science* March 20, 1987 p. 1445.

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> essentially involved in the redistribution of wealth and privilege. Hence, in its most recent version, crime is seen as a species of economic behavior or even recreational behavior. Crime is viewed as expressing a grievance and, hence, belongs to the same family of social behavior as gossip, ridicule, and punishment. Ultimately, crime comes to be viewed as one more type of behavior that helps to ensure, not undermine, social control. Crime is simply viewed as a normal way to evolve a doctrine of self-help. In such a pure democratic view, it is the continuum between criminal and non-criminal behavior that is central, not the nature of the criminal element. The very distinction between normal and criminal behavior is reduced to the whimsical nature of law in society.[3]

Horowitz goes on to add that this ideological trend "is yet one more illustration of the same theme witnessed in each of the social sciences: relativism in behavior rather than absolutism of moral claims; rights to those who choose to be different or cannot help themselves from being different; and a sharp opposition to differentiation or stratification because of biogenetic or socially induced differences in behavior".[4]

This egalitarian outlook of modern science that Horowitz identifies is reflected in a recent critique of genetic research by Dorothy Nelkin and M. Susan Lindee. The authors try to show that society has accepted genetic research to such a degree that genetic explanations are a staple of American culture. Next to Paul Bunyan and Babe his Blue Ox, the gene represents more than the physical unit of heredity but also the latest piece of American folklore. From obesity to personality traits to crime, Nelkin and Lindee argue, genes overshadow cultural and environmental explanations of various human afflictions. The authors refer to this as "genetic essentialism," which they consider to be a reductionist view that disregards any

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[3]Horowitz, Irving Louis *The Decomposition of Sociology* Oxford University Press, 1983; p 216.

[4]Ibid, p. 218.

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causal factor beyond the molecular level.[5]

The problem with this rationale is that it rejects valid scientific claims not on the grounds that such findings are inaccurate, but that such empirical work (in this case the gene as a "cultural icon") some how takes on a subjectively misleading life of its own. In cultural terms, genetic explanations are subject to misleading generalizations but then so are sociological explanations. In fact one could argue that the broad appeal of genetic explanationss is a reaction to the prevalent yet hollow theories of cultural relativism. By attributing to these researchers the view that genes "determine" human behavior, the authors misrepresent the work of behavior geneticists. Any misunderstanding that exists over the implications of genetic studies is primarily the fault of critics who either refuse to accept or lack an adequate understanding of the conceptual issues involved with this type of research. The basis of Nelkin and Lindee's argument rests upon unfounded assumptions and exaggerated claims. What *really* seems to concern Nelkin and Lindee is the idea that genetic explanations are eroding away the facade of egalitarianism.

Social scientists like Nelkin and Lindee are swimming against a tide of scientific research that points to the significance of genetics in personality traits, intelligence, alzheimer's disease, obesity, temperament, aggression and violent crime. A consensus is emerging over the biological factors of anti-social behavior, which is reflected in the latest Ciba Foundation study. (Ciba sponsors about eight international multidisciplinary symposia each year on various scientific issues.) The results of a two day seminar on the genetics of anti-social behavior, edited by Sir Michael Rutter, were published by Wiley late last year. The text consists of fifteen papers and is divided into four sections. After each paper and section there is an exchange of comments that gives the reader a better understanding of the differences among these researchers, many of whom are prominent scholars in their own fields. the text, the discussion sections offer some insight on how these researchers approach the complexity of the issues involving the biological factors of crime.

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[5]Nelkin, Dorothy and M. Susan Lindee *The DNA Mystique: The Gene As A Cultural Icon* W. H. Freeman and Co., 1995; p. 2.

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A similar academic conference four years ago, sponsored by the University of Maryland and funded in part by the National Institutes of Health (NIH), received a great deal of scrutiny in the media. Intense pressure was placed on both the conference organizers and NIH officials from political activists who eventually forced its cancellation. The conference, which reconvened last year on the eastern shore campus of the University of Maryland, again attracted a number of protestors and critics who, in the presence of print and broadcast media, tried to portray the participants as extremists and rogue academics. As the Ciba papers show, genetic studies of malevolent behavior is advancing to the degree that criminologists can no longer afford to ignore this body of scholarship.

The Ciba participants point to several consistent correlates of anti-social behavior, including: sex, age, family cohesion, peer pressure, ineffective discipline and a pattern of criminality within families that forms the framework of their comparative work. One aspect that Rutter draws attention to is the fact that recent crime trends do not correspond either with levels of "income inequality" or in some nations high unemployment levels. University of Virginia psychologist Irving Gottesman emphasizes the probablistic rather than deterministic nature of genetic factors. This brings out the conceptual difference that distinguishes a scholar who studies genetic links to crime from his critic who exaggerates the views that are often attributed to him. A behavioral predisposition, given that a common set of characteristics alters the statistical odds that an individual will more likely than not establish a life of crime, is not tantamount to saying that such an individual by fate is genetically *destined* for a life of crime. The combination of circumstance and risk factors (predispositions) generally *influence* one's chances of committing a crime and repeatedly breaking the law. In other words, certain biological factors may increase the odds of entering a life of crime.

One symposium paper, "Issues in the search for candidate genes in mice as potential animal models of human aggression," by University of Connecticut psychologist S. C. Maxson addresses the relevance of controlled animal experiments that examine the heritable dimension of violent behavior and the implications this may have for human behavior. Since the Ciba symposium, researchers at the Johns Hopkins University confirmed that genetically altered strains of mice became more aggressive and eventually killed other mice. These so-

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called "knock out" mice were bred without the normal levels of nitric oxide synthase. The experiment underscores the preliminary findings that Maxson highlights, which is that slight changes in one enzyme can increase levels of aggression and violent behavior in mice.[6]

The conference participants also recognized the influence of alcohol in the commission of a crime, an area in which these researchers found little if any disagreement. The findings from a Swedish adoption study indicate that,

> different genetic and environmental antecedents influenced the development of criminality depending on whether or not there was associated alcohol abuse. Non-alcoholic criminals mostly committed petty property offenses, whereas repeated , violent crimes were characteristic of early-onset (male) alcoholics. The predisposition to different kinds of antisocial behavior and alcohol abuse seems to be related in part to underlying inherited personality dimensions which are continuously distributed and interact with social and environmental circumstances.

Adoption studies offer a unique approach to ferreting out biological from environmental influences of behavioral traits. One of the largest adoption studies to date, the Danish Adoption Cohort has identified, among other things, an "increased rate of schizophrenia in the adopted-away offspring of biological fathers who are convicted of violent crimes". By comparing the conviction rates between adoptees, adoptive and biological parents, scholars are beginning to understand how shared and non-shared environments as well as heritable traits affect the development of anti-social behavior.

The final section features a couple of papers which address the ethical, legal and public policy aspects of genetic research. The issue of how much predisposition and "freewill" account for the actions of someone charged with a crime is one which the U.S. courts have only lightly touched upon. The problems that face technologically advanced societies are unlikely to be resolved unless there is an

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[6]Nelson, Randy J. (et. al.) "Behavioural Abnormalities in male mice lacking neuronal nitric oxide synthase" *Nature* Vol. 378; November 23, 1995, pp. 383-386.

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ethical framework which respects scientific endeavors and, to this extent, the eminent psychologist Raymond B. Cattell is perhaps one of the few pioneers who has probed this complex area to any depth.

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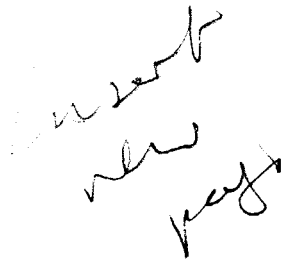

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Caucasus-Aegean-Etruria: A Bronze Age Etrusco-Luwian Diffusion

Edgar Bowden

The resemblance of Armenian EBA Kuro-Araxes Culture round-rectangular houses and Araxes Ware to Cretan EBA house-tombs and Barbotine Ware supports the recent hypothesis of at least one diffusion of Euro-Anatolian and Armenoid proto-Etruscan influences from the Caucasus via the Troad to the Aegean and thence to Italy. Georgiev's view of Etruscan as a late West Hittite dialect fits this hypothesis, if modified to include a few Caucasian linguistic residues in Etruscan.

A Horse Cult

The discovery in the literature, reported here, of a Cretan EBA architectural and ceramic link with the Caucasus emerged from a study of the Phaistos disc (Bowden 1992, 1993, 1994) when the Etruscan sculptured heads with a sagittal crest (*op. cit.* 1994, Fig Id,e) were found in the literature and it was suggested that these derived from the crested PD sign 2 (*ox. cit.*, Fig Ic), the symbol of an original Indo-European horse cult. (Note: "Etruscan" is used here to cover both early 1st millennium BC Villanovan and the later Etruscan culture; see Strong, p. 24).

Since the previous article,[1] further evidence has been found which leaves little doubt of this interpretation and of the trans-Caucasus source of this sagittal crest. First, although the PD sign 2 crest is on a shaven head, while Indo-European pastoralists from the earliest times down to the Scythians wore beards and long hair

[1] In Dr. Bowden's previous article, "Etruscans (Tursha) at Troy and on the Phaistos disk," *The Mankind Quarterly*. 36 (1), 1995, pp 57-72, it was said (p. 63) that Schliemann's Hissarlik finds were believed to have disappeared from the Berlin Archaeological Museum. But it was later discovered that some of the inscribed vases and fragments are still there, including that which bears an apparent Cypro-Minoan II text, though detailed photographs fail to confirm whether or not the left-hand 'sign' could originally have had a second vertical cross-stroke, like C.-M. II *a* obscured by breakage and repair. The vase itself therefore needs careful examination by conservators and epigraphists.

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(Hadingham, p. 70; Trippett, pp. 38-40), an early Etruscan bronze figurine shows a thin artificial semicircular crest attached to the head of a tall, slender, long-headed warrior with two braids of chest-length hair (Massa, p. 9). Evidently, at least in Etruscan usage, the symbolic crest could be either of natural hair grown on an otherwise shaven skull, or artificial. Second, it could also be a crest on a helmet, the Greek type (Bowden 1992, Fig. 26), or the Villanovan type (Bowden 1994, p. 339; Cary and Scullard, Fig. 2.1); or the helmet itself could be crest-shaped like a forage cap (Richardson, PI. VI; Massa, p. 77, a man with the same helmet, on horseback); or again on the head itself (Massa, p. 77, a crude votive figurine); Thirdly, the trans-Caucasus horse cult origin of this crest is made virtually certain by a recent excavation in Kazakhstan of a man, probably a chieftain-shaman as proposed for PD sign 2 (Bowden 1992, 1993), decapitated and then buried with a horse's head replacing his own, corresponding to a legend in the RigVeda (David Anthony, reported in *The Sunday Telegraph*, London, 9 April 1995, p. 19). Finally, the trans-Caucasus origin of this crest is also confirmed by a silver vessel from the Maikop *kurgan* (Early Trans-Caucasus Culture III, 2300-2000 BC; Burney and Lang, p. 75) showing Przewalski's stiff-maned horse; its bones were buried in south Russia at the same period. Cave drawings of horses at Kobistan on the river Kura estuary (east Caucasus, E.T.C. III; Burney and Lang, pp. 40-1) show the route and date of the movement of herded horses through the Caucasus, just as posited (Bowden 1 992, Fig. 44 and p. 1 73).

While it is clear that this crest derived from early Indo-European pastoralists on the sub-Urals steppe, who over a millennium later in India produced the Vedic texts but at that early stage probably spoke a proto-Indo-Greek dialect, it is not yet clear whether the crest was created within the Indo-Greek culture, or was copied by Caucasian proto-Etruscans directly from the Indo-Greeks' horses when the latter were first seen during some type of inter-ethnic contact, peaceful or warlike, on the north Caucasus fringes. In either case, it was certainly the mark of the warrior chieftain, and probably also of the tribal shaman in those early times, if indeed the shaman did not wear a full horse-skin mask rather than merely its stiff mane. The fact that a crested cap was somehow acquired by Tibetan Buddhist monks, where horse pastoralism existed among the Turkic tribes of the north-east

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along with excarnation by vultures and even 7-metrical chants (Bowden 1992, pp. 62, 184, 219, etc.), suggests that it must have existed on the sub-Urals steppe also, diffusing both east and west. Its presence in Tibet may be correlated with Europoid skulls in Shang dynasty tombs, circa 1400 BC, at AnYang, ShanXi province, north China, and the ABO/A2 European blood groups found there (Professor Stanley Garn, *Encyclopedia Britannica*, 18, p. 976). Mummified remains of these Indo-Europeans have been found in the central Asian deserts (Hadingham), but none with the sagittal crest, which was probably always rare, worn only by chiefs and shamans.

Houses, Death Cult and Pottery

The Cretan EBA shows a distinctive type of tomb (Dickinson, Fig. 6.2, e@c and pp. 217-8) the origin of which is said to be "mysterious". It is called a "house tomb", having a circular stone structure, formerly domed and roofed with wooden beams supporting brush or reeds, with rectangular buildings attached and subdivided into rooms. Corpses were exhumed and then reburied elsewhere in the tomb after excarnation by partial decay, but with some of the bones discarded and mainly the skulls and larger bones retained. If the origin of these tombs was indeed "mysterious", it was because no-one looked far enough east, out of an ideological denial of the possibility of human migration or ethnolinguistic diffusion across the breadth of Anatolia. In fact, the model for the Cretan house tombs and their associated excarnated burials is in the EBA Kuro-Araxes Culture of Armenia (Lang, p. 74), where round-plus-rectilinear stone houses are identical to the Cretan tombs, even to the 7 meter diameter of the round chambers and the original wickerwork roof. The circular house form derives from round wattle-and-daub huts of the E.T.-C. I of Georgia, Armenia and Daghestan (Burney and Lang, pp. 57-8), with skeletons under the floors probably having been buried intramurally; if so, then it is almost certain that they would have been excarnated in some way before final burial, either by prior burial as in Crete, or by carrion birds as at Neolithic Çatal Hüyük (Mellaart, pp. 23, 65, 167). That excarnation by carrion birds was practiced in the Caucasus region is suggested by the legend of the Argonauts' voyage to Kolkhis, where it is said that male corpses were excarnated in trees by carrion birds, though females were buried

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(Graves). The Zoroastrian (Parsi) religion uses excarnation by vultures, probably introduced by the Magi, said to be a non-Indo-European sect from Media, south Caucasus (Moulton; Diakonoff), as suggested by their Armenoid profile (Marshall Editions). PD sign 31, a bird carrying an object in its hooked beak, probably implies an excarnation cult of proto-Etruscans in the Troad.

These wattle-and-daub Caucasian houses with underfloor burials are very likely the source of a certain type of Etruscan cinerary urn in the form of just such a hut; a swastika painted on the eaves suggests a north-west Anatolian origin (Strong, PI. 1, 8th century BC). The concept of tombs in the shape of a house occurs not only in Crete but in Lycia (Bowden 1992, Fig. 12c), in a form apparently foreshadowed by an EBA I graffito on a funerary urn (Mellink) and by PD sign 24 as either the 'abandoned house of the dead ancestors' (Bowden 1992, P- 34), or as a charnel house of excarnation (cf. Mellaart, p. 65; Burl, p. 49; Mercer, p. 63) and in Etruria (Massa, p. 77), with cinerary urns sometimes having the same triple-layered form as Lycian house tombs (Bowden 1994, p. 341; Bloch, Pls. 13- 19), apparently a fusion of Caucasian and east European Urnfield influences.

There is evidence for human sacrifice in Crete (Dickinson, PP-197, 266-7) at Anemospilia near Arkhanes, where there is a prime example of the round-rectilinear house tombs. The Phaistos disc text provides fairly reliable evidence of human sacrifice in sign 4, a bound prisoner, and words A5, A7: 'the frenzied one ' and 'I pierce '. Stabbing and dismemberment were the Etruscan method of human sacrifice (Bowden 1994, p. 342; Bonfante, p. 263). Although there may be no archaeological evidence yet for human sacrifice in the ancient Caucasus, the Argonauts legend has the theme of sacrifice by the sorceress Medea in Kolkhis, by stabbing and dismemberment (Graves). In Etruria, the hook-nosed (Banti, PI. 51) and beaked heads of mythical demons (Bonfante, p. 162; Strong, p. 85) associated with the death cult may be a folk memory not merely of early Armenoid settlers from Anatolia, but also of excarnation by hook-billed carrion birds and of human sacrifice (Massa, pp. 41-5, Tomb of the Bulls, Tarquinia). Brachycephalic Armenoid skulls comprise about 10 per cent of burials in EBA Crete (this percentage was calculated from two source books covering the Cretan EBA, but

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the references were lost before the present version of this article was prepared).

Horse sacrifice with human sacrifice was certainly practiced by the Scythians (Trippett, pp. 124-5) and also in Vedic India (Chakraborti, p. 169; and see "A horse cult", above), so the evidence for it in a horse cult on the Phaistos disc is a further indication of cultural diffusion from the Caucasus via the Troad. It remains to find evidence in the Caucasus for horse and human sacrifice at the historical epoch when the horse cult was passed from Indo-Europeans to proto-Etruscans, who at that early epoch may well have been closely related to Hurrians.

Within the round houses of the Kuro-Araxes Culture were low, circular clay fireplaces, 1 meter diameter, with relief ornament along the upper edge (Lang, p. 74), as well as miniature hearths decorated with fantastic animal motifs and "obviously for sacrificial purposes". It is unclear from the literature whether such hearths occurred in Crete between the Neolithic and the MBA (Dickinson, p. 272), but they certainly did on the Greek mainland in the late 3rd millennium BC at Eutresis (Lerna III, House L; Dickinson, p. 262), a large raised clay hearth some 4 meters diameter, the side decorated with flames and the top edge with running spirals; the Cretan MBA examples are regarded as for sacred offerings, as in the Caucasus.

The evidence for a Caucasian-Aegean link from house tombs and hearths is strikingly confirmed by the close similarity of burnished grey-black Araxes Ware of the E.T.-C.III Culture, 2300-2000 BC, with knobbed decoration on the shoulders and incised triangular motifs around the body (Burney and Lang, PI. 36; Lang, p. 74), to Cretan Barbotine Ware with identical decoration (Dickinson, PI. 5.4, p. 111).

Language

Wellard (*op. cit.*, p. 172) lists eleven Caucasian languages which have been identified as related to Etruscan, and these are in all three Caucasian subfamilies. Hurrian is also thought to be related to Caucasian (Speiser, p. 9); like Etruscan, it is a suffixing language but uses far longer sequences of suffixes, bearing no apparent relationship to those of Etruscan.

Both Euro-Anatolian and Etruscan have much less complex verb paradigms than either Caucasian or general Indo-European. This is

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consistent with prolonged cultural contact with Caucasians, when the conjugational complexities had to be abandoned for the sake of communicating in pidgin. As suggested previously (Bowden 1992, p. 122), loss of vowel *o* in Euro-Anatolian probably also occurred during contact with the *o*-deficient North-East Caucasian languages.

Only South Caucasian (Kartevelian) (Marr and Briere) and North-East Caucasian (Dumézil) languages appear to show a partial similarity to the Etruscan noun suffixes having identified - functions, and in the former subfamily, exemplified by Georgian, also by the lack of any gender marker on the noun, as well as the strong tendency to vowel elision as in Etruscan, producing strings of up to six consonants. Both Etruscan and Georgian have no distinct suffix for the nominative case. Etruscan makes little distinction between the genitive and the dative, and uses suffixes in *-s* and *-l* for alternative genitive declensions, sometimes adding both to the same stem; NorthEast Caucasian does precisely the same, having *-s-l*, genitive 1 st declension masculine nouns, and *-l* alone for feminine and proper nouns; Georgian has *-s* for the dative-genitive and uses *-la* to convert intransitive verbs into action-nouns, for example 'run' to 'race-track', i.e. 'noun *pertaining* to verb', not unlike certain forms of the genitive. Hittite also uses a suffix *-ili*, scarcely Indo-European, to denote 'pertaining to a place'.

In North-East Caucasian the locative suffix is *-th* (or *-kh*) and in Georgian the instrumental , which in archaic Greek takes the same *-phi* suffix as the locative, is *-t'i* or *-it*; the Etruscan locative is *-thi*. There is no accusative in Caucasian, nor in Etruscan except (according to Pallottino) with *-ni* for emphasis; Georgian, also with no accusative case, uses *-ni* for an archaic group of nouns, which though inherently plural, are treated grammatically as singular.

The first person nominative pronoun, 'I', is *mi* and *me*, respectively, in Etruscan and Georgian.

It is not inconceivable that these suffixes in Etruscan did derive anciently from a common substratum with Caucasian, as well as *apocope*, loss of female gender, vowel-*o* and the verb complexities due to contact with Caucasians; but apart from these striking similarities, everything else is dissimilar: adjectives, plurals, particles and all the verb suffixes.

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V. I. Georgiev, however (*op. cit.*, pp. 229-56), presents a strong case for Etruscan as a Late West Hittite (Luwian) dialect related to Lydian. Best and Woudhuizen follow Georgiev. His analysis is too complex to summarize here, but depends largely upon identifying with Hittite the Etruscan noun declensional suffixes. He gives an example of an Etruscan temple inscription, 3rd-1st century BC, read in Hittite:

Etruscan: muna tasu tash tul tartanium tinsh
Hittite: munna dassu dantus tuuwala *Dardanius-wa tinus
English: Hide well Dardanian deities brought from afar

Note the alliteration, common in Etruscan, as on the Phaistos disc; Etr. *tinsh* from Hier. Luw. *tin(a)*, 'god'; Etr. *v* here as *u*.

Woudhuizen (*op. cit.*) mentions, but dismisses, the view of Adrados (*op. cit.*) on Etruscan as derived from a hypothetical Old Euro-Anatolian substratum, while Klimov mentions Bopp's 1847 view of Kartevelian as the Caucasian branch of Indo-European, which he says is rejected by modern Caucasian specialists. A combination of these two hypotheses might be consistent with the observed linguistic affinities of Etruscan with both Caucasian and Euro-Anatolian, but it would not alter the model here presented of a diffusion of proto-Etruscan and Euro-Anatolian conjoint ethnolinguistic influences from the Caucasus to the Mediterranean through the Troad. Whether Etruscan is a *Mischsprache* or a relic of a very ancient I.-E./Caucasian superfamily, the Armenoid profiles of Hittite statuary and on the Lemnos stele (Bowden 1994, Fig. 1e) with an Etruscan-like language, do imply a joint ethnolinguistic influence diffusing far to the west and this may be consistent with Palmer's (*op. cit.*, p. 334), Pope's and Georgiev's (*op. cit.* p. 88) views on Linear A as a Luwian-like language, especially if there had been a very early movement of Luwians through the Troad near the beginning of the 3rd millennium BC, linguistically little affected during a brief contact with Caucasians (Bowden 1992, 1994). According to Georgiev (*op. cit.*, p. 361), this earliest Pelasgian linguistic stratum had affinities with Luwian and with the proto-Indo-Greek subfamily.

An alternative form of 'Pelasgian' is 'Peleset', the branch of the Lukka (Lycian) Sea People who settled in the eponymously named

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Palestine in the 12th century BC. The war hat of the Sea People, seen also on a Peleset sarcophagus, does not resemble the sagittal crest of PD sign 2 (Bowden 1994, Fig. 1f and p. 339), but it may nevertheless be identifiable as a tribal totem symbol, from Herodotus's account of Lycian sailors wearing "a cap set about with feathers". In their passage through the Caucasus and Anatolia, even the first (Luwian) Pelasgians could have acquired at least the folk memory, if not the practice, of the same excarnation by carrion birds that is seen on the Phaistos disc in PD sign 31. Hedges (*op. cit.*, P- 57) observes that the white sea eagle eats carrion, just as do eagles in the excarnation cults of Mongolia and Chinese central Asia (*op. cit.*, p. 133 ff). It is therefore plausible that the war hat of the Lukka and the Peleset was a circlet of white sea eagle feathers, as a totem from their trans-Caucasian migration. Perhaps this proposed distinction between the two totemistic head adornments will at last end the confusion between them.

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